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PREHISTORIC STONE IMPLEMENTS OF NORTHEASTERN ARIZONA

BY

RICHARD B. WOODBURY

REPORTS OF THE AWATOVI EXPEDITION
REPORT NO. 6

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PREFACE

THE purpose of this report is to analyze the stone artifacts from a group of sites in northeastern Arizona, excavated by the Peabody Museum Awatovi Expedition of Harvard University. Because of the large number of objects, over 8,000, and the long occupation represented by the sites, nearly 12 centuries, it will be possible to make some generalizations about the time of appearance and disappearance of certain kinds of tools and ritual equipment, and their apparent importance at different times. Furthermore, the fact that Awatovi, the largest ruin dug and the source of the majority of the artifacts, was a village of the Hopi Indians abandoned only within historic times provides a continuity between the past and present occupation of the region. On the basis of ethnographic information concerning Hopi culture, as well as of careful examination of the artifacts themselves, a number of suggestions are made as to their probable functions. A knowledge of such functions is a valuable step in piecing together the record of the life of the ancient inhabitants of this region.

Descriptions of these artifacts are given in considerable detail, because in the present state of archæological studies in the Southwest it is impossible to find any single system of names, types or categories that is generally accepted or used. For descriptive purposes the artifacts have been divided into categories such as Manos with Single Grinding Surface, Polishing Pebbles, Bowl-shaped Mortars, etc. After the descriptive data for each category or group of categories, there are remarks on the distribution in both time and space of similar objects reported from other sites, and of probable uses of the artifacts.

The following general conclusions are discussed:

1) During the nearly 14 centuries represented by the prehistoric occupation of the Jeddito district and by the modern Hopi Indians, there has been remarkable continuity in the forms of stone artifacts. Many have persisted almost unchanged throughout the entire period.

2) There has been a constant increase in the variety of stone tools employed, and development of more and more specialized artifacts for specific purposes. Most of these provide alternative and improved ways of doing relatively common tasks, but some meet new needs.

3) With a few notable exceptions, stone artifacts in the Jeddito district are less useful than pottery as diagnostic criteria for minor chronological divisions of the area's history. The change from troughed to flat metates, occurring at the end of Pueblo II times, is the most clear-cut chronological distinction noted.

4) Although the Jeddito stone material is characteristically Puebloan, as are other aspects of the culture, there are some links with the Mogollon and Hohokam Cultures, in the form of specific or generalized similarities in stone traits. There are also a few specific connections with the San Juan area and also with the Rio Grande.

5) Although data from ethnographic studies of the Hopi furnish a scanty basis for judgment of material culture, many of the kinds of artifacts found by excavation continue in use to the present time. Several of these are now unique to the Hopi, such as loomblocks and the raised-border palettes with hemispherical stones for grinding paint, or to the Hopi and the Keresan or Zuñi Pueblos of New Mexico, such as small carved mountain lion figures and tcamahias (hoe-like objects, used ritually). There are also a number of objects known only from Awatovi, or extremely rare elsewhere, such as pestles of a distinctive form, and cupped stones.

The text of this report was completed in essentially its present form in the summer of 1948, with only minor revisions and the addition of a section on technics of manufacture during 1951 and 1952. Consequently, there are no references to a number of important and valuable studies appearing subsequently to 1948. I particularly regret that when this report was begun I did not have the benefit of the several recent evaluations of the Southwest by Erik K. Reed that have appeared in *El Palacio* and *Southwestern Journal of Anthropology*. The intermediate status of the Jeddito area between the San Juan Anasazi and the Little Colorado district[1] might have been more sharply brought into focus in this study if at its commencement it had been better recognized as a hypothesis to be checked and as a viewpoint to aid in the evaluation of the data.

Columbia University
in the City of New York
January, 1954

RICHARD B. WOODBURY

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[1] Reed, 1946, p. 303.

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THIS study was made possible by the excavations of the Peabody Museum Awatovi Expedition, in which I had the good fortune to take part. I am deeply grateful to the Museum, to its former Director, Mr. Donald Scott, and to Dr. J. O. Brew, the present Director and also the Director of the Expedition, for assistance, encouragement and support in this study. The enthusiastic cooperation of all members of the Expedition staff made possible the immense chore of keeping the field catalogue up to date during the excavations. I am particularly indebted to Mrs. Helen Claflin Spring, to Mrs. Penrose Davis Worman, to Dr. Carlos Garcia-Robiou, and to Mr. E. Mott Davis. The study of the Jeddito stone artifacts was initiated by Mr. Richard P. Wheeler, who generously turned over to me his preliminary notes.

Many people have given help and encouragement at various times during the course of this work. For assistance in the examination of various museum collections I wish to thank Mr. Neil M. Judd, formerly of the United States National Museum, Dr. Harold S. Colton and Miss Katharine Bartlett of the Museum of Northern Arizona, Mr. Stanley A. Stubbs of the Laboratory of Anthropology, and Dr. Bertha Dutton and Mrs. Marjorie Lambert of the Museum of New Mexico. At Harvard University, the late Dr. Kirk Bryan and Dr. John T. Hack assisted with identifications of certain rocks, and fossils were identified by Dr. Preston E. Cloud, Jr. and Mr. Robert M. White. Inquiries on various specific problems were aided by the kindness and cooperation of the late Dr. Elsie Clews Parsons, of Dr. Mischa Titiev, Dr. Alfred V. Kidder, Dr. John B. Rinaldo, Dr. Fred Eggan, Mr. Harold S. Gladwin, Miss Katharine Bartlett, Mr. Earl H. Morris, Mr. Carr Tuthill, Dr. Emil W. Haury, and Mr. Carroll Burroughs. Helpful suggestions and criticisms during the course of the laboratory work have come particularly from Dr. J. O. Brew, Dr. Alfred Kidder, II, and Dr. Hallam L. Movius, Jr. My wife, Nathalie F. S. Woodbury, has generously assisted in the laborious task of rechecking minor and major details and preparing the manuscript for publication.

The maps and drawings were prepared by Mrs. Worman, and the photographs of specimens are the work of Mr. Frederick P. Orchard of Peabody Museum.

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PREHISTORIC STONE IMPLEMENTS OF NORTHEASTERN ARIZONA

Part I

An explanation of the subject matter and procedure of this study, with a brief discussion of the reasons for undertaking it.

INTRODUCTION

THE AREA AND DATA TO BE CONSIDERED

THE stone artifacts which form the basis of this study come from five seasons' excavations by the Peabody Museum Awatovi Expedition, from 1935 through 1939, in the Hopi country of northeastern Arizona. A summary of the expedition's accomplishments, by Dr. J. O. Brew, the Director, has been published as the preface to the first of the final reports of the Expedition.[1]

GEOGRAPHICAL LOCATION

The Southwestern part of the United States is generally regarded as divided into three parts, a northern plateau, a central mountainous zone running approximately from northwest to southeast, and a desert or lowland area in the south. Northeastern Arizona lies on the plateau and is drained chiefly by the Little Colorado River (*see* fig. 1). One of the principal topographic features of the region is Black Mesa, from the southern border of which half a dozen intermittent streams flow southwest into the Little Colorado. The easternmost of these streams is the Jeddito Wash. Between Jeddito Wash and Polacca Wash to the northwest lies Antelope Mesa.[2] Here are located the ruins of Awatovi and several other large pueblos, all overlooking the Jeddito Valley (fig. 2). The next three mesas to the west, roughly paralleling Antelope Mesa, are referred to as First, Second and Third Mesas and the modern Hopi villages cluster around their tips.

Although this area is a considerable distance from Zuñi, Ácoma, and the Rio Grande Pueblos, it cannot be regarded as geographically isolated. The intervening region once supported a sizable pueblo population and well-travelled trade routes connected the Jeddito pueblos with settlements to east, west and south. This trade continues today, more or less independent of the white invasion of the region. The Hopi, like other Pueblo Indians, are great travellers and have an intimate knowledge of many distant regions.

The physiography, climate, and potentialities for subsistence of the Jeddito area have been carefully described by Hack[3] and will not be reviewed here.

CHRONOLOGICAL POSITION

Awatovi, the only large site in which extensive excavation was undertaken, was occupied from early in the 13th century to the beginning of the 18th. Other excavated sites, ranging in size from single dwellings of one or two rooms to villages of nearly a hundred rooms, were occupied from shortly after 500 A.D. until a century or two after the settlement of Awatovi. Thus a time span of about 1,200 years of continuous occupation has been investigated. In addition, there is a continuity between the inhabitants of Awatovi and the modern Hopi. At the time of the Spanish Conquest (1540) Awatovi was a Hopi town, and at its destruction at least a part of its survivors moved to the other Hopi towns. Therefore, 1,400 years or more is represented by the excavated sites and the modern towns, taken together.

This long period of time offers an excellent opportunity for the study of cultural changes, and it is fortunate that the Hopi preserve more of their old ways than do most Indians in the United States. Systematic studies of Hopi material culture are few and brief, but enough can be gleaned from observations during the past three generations to allow some comparisons with the culture of the more remote past.

CULTURAL POSITION

During the last 1,400 years the Jeddito area has supported a predominantly agricultural population. In the past hunting probably occu-

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[1] Hack, 1942a, pp. v–x.

[2] Sometimes called Jeddito (or Jeditoh) Mesa, as in Fewkes, 1898a, or Awatovi Mesa, as in Hough, 1903.

[3] 1942a.

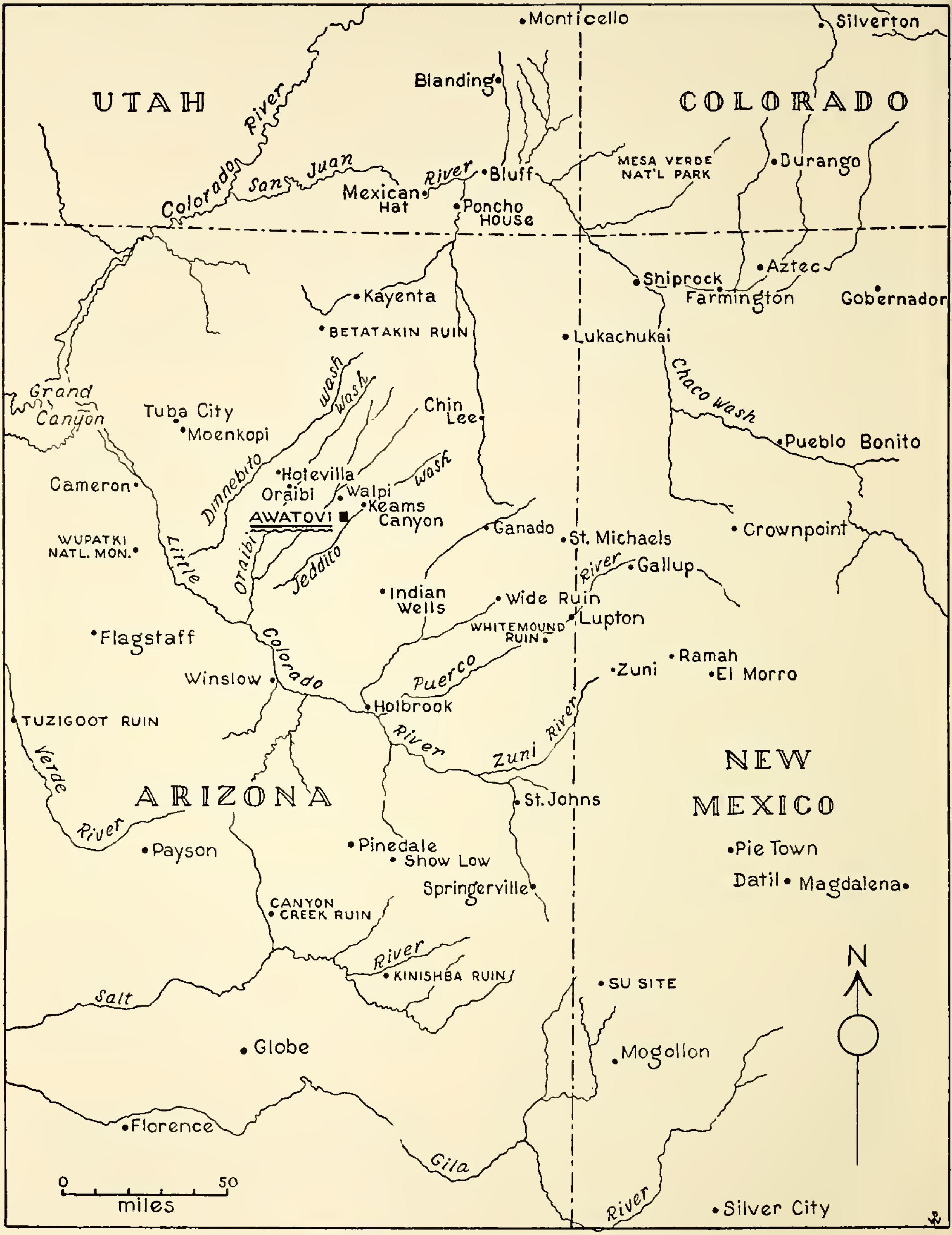

FIG. 1. NORTHERN AND EASTERN ARIZONA AND PARTS OF ADJACENT STATES, showing location of Awatovi and Jeddito Wash.

pied a considerably larger role in the subsistence economy than at present, but hunting and gathering were a supplement to the basic diet of agricultural products. The population has been sedentary during this period, but the pattern of occupation has changed from a large number of very small settlements to a few towns with populations in the hundreds. This is probably the most striking change that has occurred, since it has entailed profound changes in architecture and it implies a corresponding series of changes in social and political organizations.

Northeastern Arizona lies within the area of the Anasazi Culture, one of the four basic divisions of the Southwest. In Gladwin's classification, the Jeddito area belongs to the Kayenta Branch of the San Juan Stem.[4] And according to Colton's system, for the Museum of Northern Arizona,[5] it belongs to the Tusayan Branch of the Anasazi Root. The cultures of these 14 centuries may be divided into chronological periods. The systems in use by various Southwestern archæologists are shown in table 1.

Throughout this report chronological identifications are made in terms of the original Pecos Classification. It is used in preference to Roberts' Revision because the appellations are briefer, more convenient, and are in common use by many Southwesternists. The Gila Pueblo Phase System, devised by Gladwin, is not used here because since it was tentatively proposed the phases have never been adequately defined. Furthermore, both it and Colton's Focus System (Museum of Northern Arizona) not only imply chronology, but also the position of the site in a hypothetical system of cultural evolution. The cultural relationships of the Jeddito sites are not yet sufficiently worked out to justify their placement in a Phase-Branch-Stem system. Furthermore, there are serious methodological difficulties in these schemes, which arise from their use of a "family-tree" approach to culture history. This problem has been analyzed critically, and in great detail, by J. O. Brew,[6] and an evaluation of Colton's 1939 Focus System may be found in a review by Erik K. Reed.[7] Colton's outline of Foci and Phases is the most satisfactory refinement of the Pecos Classification that has yet been made for the Jeddito district. It provides ten pigeonholes for the 14 centuries instead of six. Unfortunately, this report on stone artifacts was prepared before the analysis of the pottery and architecture was completed for most of the sites, so breakdown of the chronology into finer subdivisions than those of the Pecos System is not yet justified. Artifacts are tabulated by site, even when several sites are considered tentatively as of the same age. The finer division made for the Awatovi specimens, on the basis of associated pottery styles, is explained below.

The Pecos System is used with full realization of its imperfections. Such criticisms as that of Kluckhohn[8] are fully justified. But within the Pueblo area it is still a convenient device for referring to the approximate chronological position of a site, as judged chiefly on the basis of its pottery and architecture. Since some of the Jeddito sites either do not exactly fit the criteria of any single period in the Pecos System, or were occupied during a transitional era, it is convenient to use such terms as "Pueblo I-II" and "Pueblo II-III." Some of the sites are known to have been occupied during two or more successive periods of the Pecos System, and when it has not been possible to assign artifacts to a particular period of the site, a blanket designation is given, such as "Pueblo III-IV."

THE SITES

Although the artifacts considered in this study come from 26 sites, a very large part of the total (87 per cent) is from Awatovi, and nearly all the rest are from a few of the 18 excavated sites. The following brief description of the sites is based on field studies and on preliminary laboratory work by members of the Expedition Staff. Complete reports will be published by the Peabody Museum. For the locations of these sites see the map, figure 2.

Awatovi. A large pueblo ruin, covering 23 acres (fig. 3). Over 1,000 rooms were exca-

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[4] Gladwin W. and H. S., 1934.

[5] Colton, 1939.

[6] Brew, 1946, p. 44.

[7] Reed, 1940.

[8] Kluckhohn and Reiter, 1939, p. 151 *et seq.*

TABLE 1: Chronological Systems Applicable to Northeastern Arizona. (The original Pecos Classification, shown in the first column, is used in this report. All dates are approximate.)

Pecos Classification		Gila Pueblo Phase System†	Museum of Northern Arizona Focus System††	Approximate Dates
Original*	Revised**			
. .	. .	. .	. .	1900
			Oraibi Focus	
		Hopi Phase		
Pueblo V	Historic Pueblo			1800
			Payupki Focus	
				1700
		Sikyatki Phase	San Bernardo Focus¶	
. .	. .	. .	. .	1600
			Sikyatki Focus	
Pueblo IV	Regressive§ Pueblo			1500
		Jeddito Phase		
				1400
			Jeddito Focus	
. .	. .	. .	. .	1300
		Sagi Phase	Hukovi Focus	
Pueblo III	Great Pueblo§§			1200
		Tusayan Phase	Polacca Focus	
. .	. .	. .	. .	1100
Pueblo II	Late Developmental Pueblo	Kaibab Phase	Kiako Focus	1000
. .	. .	. .	. .	900
Pueblo I	Early Developmental Pueblo	Marsh Pass Phase	Marsh Pass Focus	800
. .	. .	. .	. .	700
Basket Maker III	Modified Basket Maker	(not named)	Lino Focus	600
. .	. .	. .	. .	500
Basket Maker II	Basket Maker			

* Kidder, 1927.
** Roberts, 1936 and 1937.
† Gladwin, W. and H. S., 1934, fig. 7.
†† Colton, 1939. The Foci listed here are grouped into Phases and larger units.
¶ Formerly San Bernardino Focus.
§ "Renaissance" has been suggested as a better term.
§§ Sometimes called "Classic Pueblo."

vated during the 1935–1939 seasons, including 25 kivas. Several stratigraphic tests were made in extra-mural refuse dumps. The most intensive work was done in the parts of the town occupied during the 17th century, particularly the buildings of the Franciscan Mission, and the adjoining Indian houses. The oldest part of the town, near its western edge, was found to have been settled in the 13th century, during late Pueblo III. Awatovi's destruction and

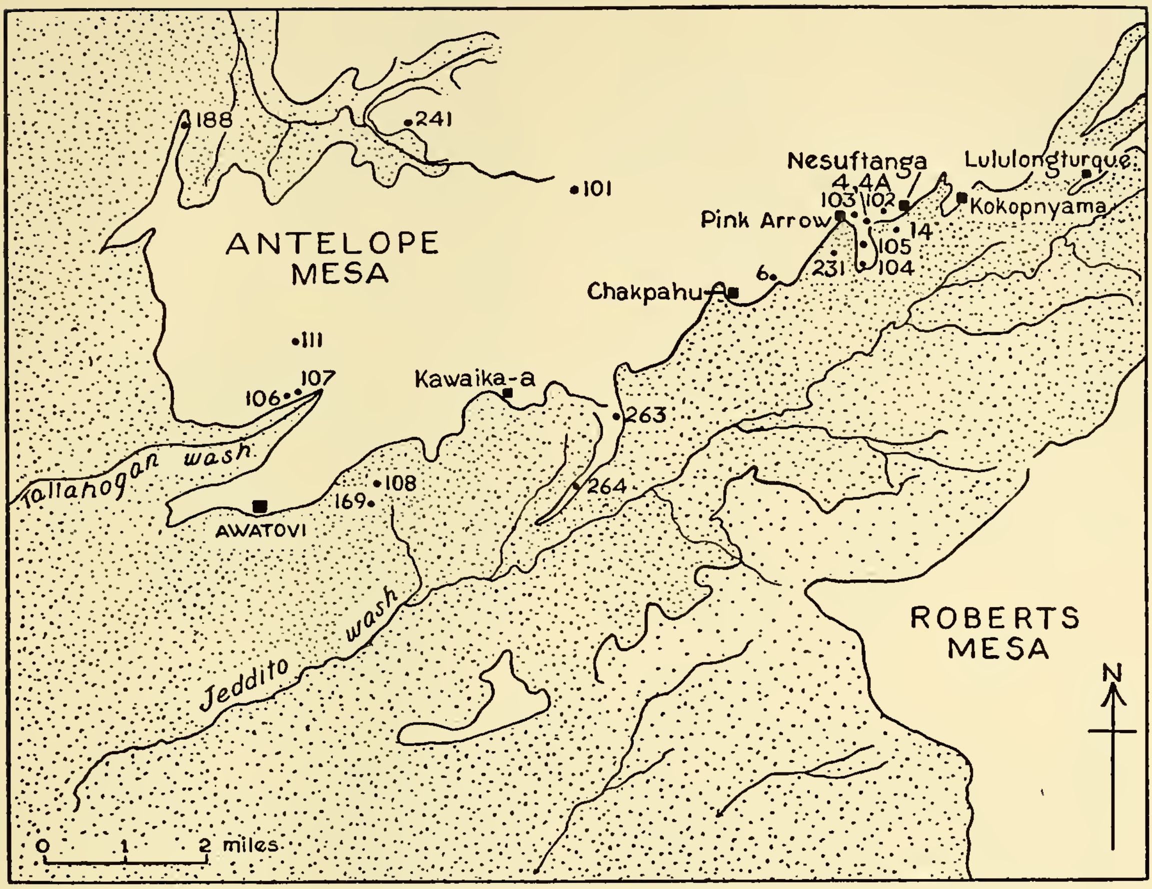

Fig. 2. Location of Excavated Sites in the Jeddito District, with a few others from which surface finds are mentioned in this report.

abandonment shortly after 1700 is a matter of traditional Hopi history, substantiated by documentary and archæological evidence.

Kawaika-a. A large pueblo ruin similar to Awatovi, but probably abandoned between 1500 and 1540, just prior to the arrival of the Spanish.[9] Excavation was limited to a few kivas and stratigraphic tests.

Chakpahu and Kokopnyama. Large sites comparable to Awatovi and Kawaika-a, probably occupied until the 16th century. No excavation, and only a very few surface finds.

Old Shungopovi. Probably contemporary with Awatovi, and, like Awatovi, the site of a Franciscan Mission during the 17th century. No excavation, and only a very few surface finds. Old Shungopovi is located at the foot of Second Mesa, near the modern pueblo of Shungopovi (also called Shongopavi and Shimopavi.)[10]

Pink Arrow. A small pueblo on the mesa rim. Thirty-two rooms and a kiva excavated. It was named by Mrs. W. C. Roberts of Jeddito Trading Post, for an unusually attractive arrowpoint found there some years ago. Occupation, Pueblo III-IV.

Sites 4 and 4A. Two small sites, quite completely excavated. About 40 rooms consisting of pithouses, surface rooms and kivas were dug, and several stratigraphic tests in refuse. Occupation, Basket Maker III through Pueblo III.

Site 101. A small Basket Maker III site, which yielded no stone artifacts.

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[9] Reed, 1942, pp. 119–20.

[10] Colton and Baxter, 1932, p. 42. Hargrave, 1930.

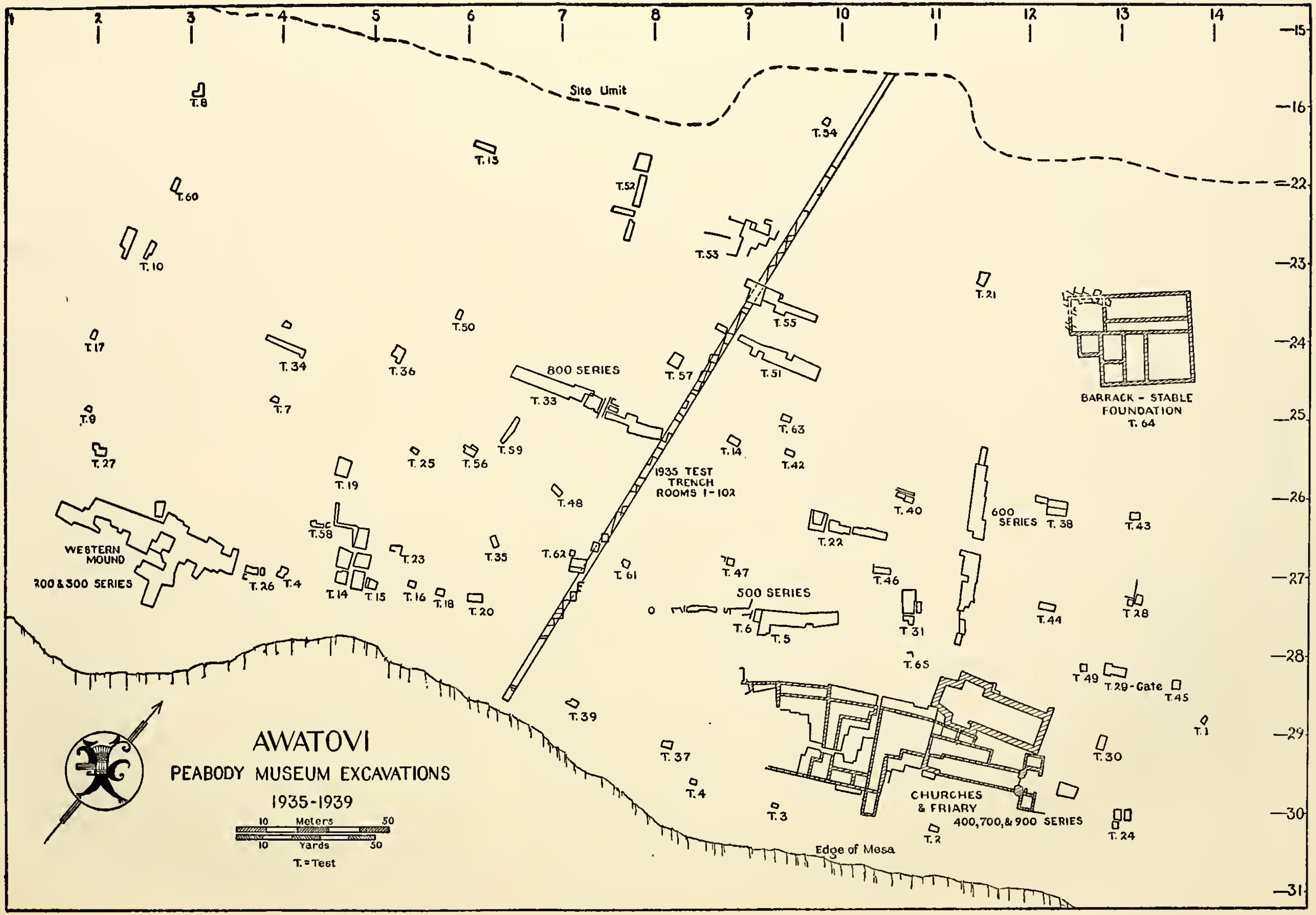

Fig. 3. Awatovi, showing location and extent of excavations. Individual rooms are not shown.

Site 102. A small site, of two rooms and two outside fireplaces. Occupation, Pueblo II.

Site 103. A three room site. Occupation, Pueblo II.

Site 104. A series of small units, just below the mesa rim. Nineteen rooms and a kiva were dug. Occupation, Pueblo II-III.

Site 105. Nine rooms. Occupation, Pueblo II-III.

Site 106. An eight room unit. Occupation, Pueblo III.

Site 107. Fourteen rooms and a kiva were dug. Occupation, Pueblo I to III.

Site 108. Below the mesa rim, on the first bench. Eight rooms and a kiva dug. Occupation, Pueblo II-III.

Sites 109 and 110. Pueblo II sherd areas without discoverable house remains. No stone artifacts.

Site 111. Five surface rooms, five pithouses or kivas. Occupation, early Pueblo II.

Site 169. Two pithouses. Occupation, early Pueblo II.

Site 231. Eight room site on the first bench below the mesa top. Occupation, Pueblo III.

Site 263. A sub-surface room (transition between pithouse and kiva). Several nearby surface rooms had eroded away, since they were built on a steep, still active sand dune. Occupation, Pueblo I-II.

Site 264. A large village on a point projecting out into the Jeddito Valley. Excavation included 7 pithouses, 19 isolated slab-lined storage chambers, 7 contiguous storage chambers, 1 rectangular masonry room, and 6 outdoor firepits. Occupation, Basket Maker III-Pueblo I, with a single Pueblo II room.

A few stone artifacts came from surface collections at the following sites: 6, 14, 18, 22, 126, 188 and 241. Their chronological positions are indicated in table 2.

PROCEDURE OF FIELD AND LABORATORY WORK

THE DATA

Since the manner in which the data of any archæological study were collected is pertinent in judging the conclusions drawn from them, the system of field and laboratory study will be described briefly here. Archæological method in the Southwest, and to a considerable degree in the entire United States, is becoming standardized mainly on the basis of informal cooperation, discussions and visits between archæologists. There are still numerous minor differences in procedure which are seldom made explicit in reports, and which may have an effect on the value and reliability of the data, especially for comparative work. In many monographs the methods of field work and analysis are not described, and to the beginner or the student of another discipline may be quite unfamiliar, seeming rather complex and mysterious. Actually, the field technics which are becoming standard are quite simple, consisting mainly of convenient ways of making and recording a large variety of detailed observations on objects, structures, refuse, skeletons and other remains of human occupation. Personal experience and awareness of the problems under consideration invariably influence the selection of details for recording, but it is desirable to follow a routine that will prevent any important details being overlooked. Completeness and precision are always worthwhile, and every archæologist can recall instances in which details that seemed trivial and meaningless at the time they were recorded turned out to provide answers later on to important questions.

In the field work of the Awatovi Expedition the location of all material excavated was recorded in terms of horizontal and vertical units, and rarely in distances or angles from fixed points. The horizontal unit was usually a room (numbered consecutively at each site) or sometimes a test pit or a 2-meter square of a test trench. These rooms, tests and trenches were mapped with telescopic alidade and plane-table as the work progressed. At Awatovi the map sheets were identified by means of a grid system, but at smaller sites this was unnecessary. The vertical unit was generally a 50-centimeter layer in the fill of room or pit, but when floors or other horizontal discontinuities were encountered units of greater or less size were used. The 50-centimeter intervals were measured from an assumed datum plane projected from a reference point near the surface on one of the walls. Thus an object would be recorded as coming, for example, from Site 111, Room 4, 50-100 centimeters, or from Awatovi, Test 42, 250–300 centimeters. The absolute elevation of the reference points, and hence of all vertical measurements, was recorded on the plane-table maps. Objects found on floors, in burials, or otherwise *in situ* were specially recorded as circumstances required.

In each unit thus excavated all potsherds were saved and either sorted and tabulated in the field or shipped to the museum. Therefore, for each specimen of stone (as well as bone, metal, shell, etc.) there is a record of the location ("provenience" is the term here used) in which it was found and of the associated architecture, pottery and other cultural traits. On this basis each artifact could be assigned to a position in the ceramic chronology, sometimes also dated on the basis of associated wood or charcoal. At Awatovi objects of European origin, and a knowledge of the architectural growth of the site also aided in dating artifacts. Nearly all the material came from refuse, the debris of occupation which had been thrown into abandoned rooms or sometimes on extramural refuse heaps. A relatively small amount of the stone material was found *in situ* on floors, in burials or in other situations indicating intentional placement. Such occurrences are mentioned in connection with the tabulation of proveniences in the text following the descriptions.

TABLE 2: Approximate Chronological Relationships of Jeddito Sites

A.D.

500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800

BM III P I P II P III P IV P V

. . . . 4 & 4A . . . .

. . . 101 . .

. . . 102 . . . .

. . . 103 . . . .

. . . 104 . . .

. . . 105 . . .

. . 106 . . . .

. . . . 107 . . . .

. . . 108 . . .

. . . 111 . . .

. . . 169 . . .

. . 231 . .

. . . 263 . . .

. . . . 264 . . . ? . ? . ? . . . .

(6) (14)

(22) (188)

(18) (241)

(Kokopnyama & Chakpahu)

(Old Shungopovi . . . .)

. . . . . . Pink Arrow . . . . . .

. . . . . . Kawaika-a . . . .

* * * * Awatovi * * * * *

B/W*

W-O

B/O

O-Y

B/Y

Y-17

17c

Sites in parentheses are represented only by surface collections.

* See p. 15 for explanation of symbols.

The recording and cataloguing procedure for the stone artifacts was based on the field catalogue. Every specimen which appeared to have been shaped or used was included, except, of course, for building stone. The cataloguing was done on 5x8 inch and 3x5 inch cards, in duplicate. Although a tedious job, it was well worth while. The smaller cards were kept in numerical order and the larger cards filed by type of artifact, subdivided by sites. Drawings on the backs of the larger cards, even though done in a diagrammatic manner, proved invaluable as a supplement to written descriptions. Certain specimens were photographed in the field, mainly those not shipped to Cambridge. The smaller objects and a considerable number of unusual or unique items were taken to the Peabody Museum in Cambridge *in toto*, but because of their bulk only selected specimens of the larger or more numerous groups such as metates, manos, pecking stones and grinding slabs were shipped. The material left in the field was buried in a large pit at the expedition camp, just as were many thousands of sherds which had been classified and counted. The 3x5 inch field catalogue cards, incidentally, provided a very convenient basis for the assignment of permanent museum numbers, while the larger cards could be kept in the museum laboratory for study.

It may appear as though the procedure outlined above is unnecessarily lengthy, but many instances have arisen during the study of the material when its value was proved. Many of the minutiae recorded in the field in a purely routine way have proved helpful in reclassifying specimens, or in checking problems that have arisen since the field work was finished. Without the precise records of provenience, based on the field maps, much of the value of the collection would be lost.

We made one serious mistake. The cataloguing in the field was done on the basis of an inadequate and not fully explicit terminology. It has been necessary to restudy and reclassify every specimen, abandoning some of the categories and terms used in the field and providing new ones. This duplication of the task of classification could have been largely avoided if, in the field, we had been more careful to define and delimit each category and term. The criteria on which observations were based should have been made a part of the field records. Terms for texture, shape, and workmanship especially were sometimes used differently by the various individuals who worked on the field cataloguing. The differences were minor, but could have been avoided entirely, by rigorous adherence to an agreed set of definitions. Probably the most convenient way to do this would have been to select "standard" specimens to which reference could be made for descriptions of material or texture, workmanship or amount of wear. A set of drawings was used for recording in a number and letter system the cross-section, shape and other details of manos, and similar charts might have been prepared for other kinds of implements. The final results of this study are little affected by this shortcoming of the field cataloguing, since the completeness of the records, and the drawings of each specimen provided a satisfactory basis for rechecking and reclassification.

Measurements are in the metric system, in accordance with the practice of Peabody Museum. All artifacts were measured to the nearest millimeter, but in this report the measurements of larger objects and of many averages have been rounded off to whole centimeters. All lengths, diameters, etc. are based on whole specimens, or ones for which the measurement concerned could be determined precisely. Sliding and spreading calipers of the type used by physical anthropologists proved invaluable for rapid and accurate measurement. Wherever means are given for measurements of size, the arithmetic mean is used.

THE PROBLEMS OF DESCRIPTION AND CLASSIFICATION

In a published report it is impractical and inadvisable to describe each specimen found at a site, unless the total number of specimens is extremely small. In the present instance, complete individual descriptions of the over 8,000 objects would require an enormous number of pages, too much to publish and too much to read. An even more serious objection to merely describing each specimen, even when the number is few, is that it would be failing to make the generalizations that are a first step in all science. Unless some order or consistency can be made in a set of facts, or a scheme devised for grouping observations and items of data, the collection of information is a meaningless occupation. So a set of categories or classes has been constructed by means of which the material can be described. Although this is such a common procedure that we tend to take classifications for granted, it is important to realize that we are imposing an arbitrary order on our data, and not recognizing any "natural" order. The way in which any classification is arrived at deserves some consideration, since it forms the framework within which the facts are reported.

Archæological classifications have been commonplace matters, uncritically accepted and used, for several generations. But in recent years doubts have arisen as to the value of some of the schemes, and suggestions have been made for less haphazard procedures. The most helpful discussion of the subject seems to me to be "The Typological Concept" by Alex D. Krieger.[11] He points out the shortcomings of the "pigeon-hole" style of classification, in which some single characteristic, usually shape, is made the basis of major headings in an outline, and minor headings added according to other criteria. Krieger recommends that "types" be established primarily on the basis of "a specific and cohesive combination of features . . ." and that "the type as a whole is also understood to occupy a definable historical position, that is, its distribution is delimited in space, time and association with other cultural material." Hence, he points out, "no matter how small the difference between specimen groups, these differences are of type importance if their distributions in space, time and cultural association are distinct." Since he suggests that types comparable to pottery types be established and given a binomial nomenclature (place name and descriptive term), it seems wise to use such terms as "category" or "group" here. Some of these categories I believe will meet Krieger's requirements, but they deserve further consideration before being proposed as types. As far as possible, I have tried to form categories that bring together implements of similar appearance, identical function, and significant geographical and/or temporal distribution. Hence there are some quite small distinctions, such as seven kinds of three-quarter-grooved axes, whenever there seemed a chance that such distinctions might have cultural significance. And conversely there are some very broad categories, such as grooved abrader, which include a great variety of specimens, whenever wide differences of shape and material and size did not appear to have significance.

This classification is not intended to be applicable everywhere. It was created for the Jeddito material specifically and for the purpose of making comparisons with other Southwestern artifacts. It is not expected that it can be used unmodified for other regions. In fact, it is a fallacy to believe that any such scheme can be created *in vacuo*, to be used on any body of material whatsoever. Brew has demonstrated that there is no "natural" single classification for a group of data, and that every system must be devised for a specific purpose.[12] Drucker has also made some particularly valuable comments on the basically empirical nature of any classificatory scheme.[13]

Besides the important problem of constructing adequate and meaningful categories or "types," terminology for stone artifacts presents serious difficulties. There are three ways in which categories can be identified: first, by names that are descriptive of shape only; second, by designations made up of numbers and letters; and third, by names carrying functional implications. The third is the most generally used in the Southwest, but the others have certain advantages, especially for some classes of objects. Strong's widely used classification of chipped stone[14] uses a letter-number system which avoids any connotations of function. The designation of "arrowpoints," "spearpoints," "knife blades" and "scrapers" is unnecessary when such a system is used, but Strong's method has been criticized on the grounds that the designations of letters and numbers are hard to remember and require constant reference to a key. As far as I know a number-letter system has never been used for the total range of stone artifacts, but only for groups such as chipped stone or manos. McGregor, for example, describes manos in terms of the combinations of 5 lettered "forms" and 9 numbered cross-sections.[15] A system of names was proposed by Black and Weer[16] which was meant to be applicable to all artifacts, and would refer only to shape. This may not have been intended as a primary basis for classification, but only as an aid to standard descriptive terminology. However, it is subject to Krieger's criticism of outline arrangements, in that logic and balanced categories govern the scheme, rather than a "combination of features." An ingenious system of terms for shapes has been made the basis for an elaborate classification of "banner-stones."[17] Here, again, the question is ignored of whether all shape differences have equal significance in terms of "distributions in space, time and cultural association."

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[11] 1944.

[12] Brew, 1946, p. 44.

[13] Drucker, 1943, p. 35.

[14] Strong, 1935, pp. 88–89. A similar system has been proposed by Finkelstein (1937).

In my opinion, functional terms are preferable whenever we can identify the function of an object beyond reasonable doubt. By analogy with modern Pueblo Indian technology and with similar cultures elsewhere we can reliably infer the uses of such things as axes and metates, and perhaps pendants, shaftsmoothers and tobacco pipes. When there is doubt, caution seems advisable. Consequently this report also uses such purely descriptive, non-functional terms as cupped stone, thick cylindrical stone and notched disk.

Unfortunately, no standard terminology for stone artifacts exists in the Southwest, and many terms are used with a great variety of meanings. There is no synonymy among authors, and it is rare to find adequate definitions of the terms in use. Kidder's "The Artifacts of Pecos" remains an outstanding example of careful and precise description, and is as close to a general standard as anyone has come. Some of the reports issued by Gila Pueblo (Medallion Papers) set a high standard in full illustration, but fall short on descriptive detail and definition. The reports of Rinaldo on artifacts from the Field (now Chicago) Museum of Natural History excavations in Colorado and New Mexico set a standard that could well be attempted by others.[18] It is discouraging that there are still many archæologists whose publications deal carefully and at length with pottery and architecture, but are so vague and sketchy in dealing with other artifacts that the information is nearly worthless. Comparative studies of stone material are greatly hampered by the common failure to report exactly what was found, and where. Until a standard terminology is developed, long and detailed descriptions will be needed.

One recent attempt to work out a standardized set of terms is that made by Paul Gebhard.[19] Since my own study was well advanced before I first discussed classification and terminology with him, I have not attempted to adopt his system. I have found a number of his distinctions very useful, even though in dealing with North America as a whole he was forced to disregard many of the minor distinctions that are important within a small area. Also, it is very encouraging that he was able to construct broad and significant hypotheses concerning American prehistory mainly on the basis of the data on stone artifacts in a few dozen major reports and a scattering of minor ones. A few generations of really painstaking archæological reporting should provide the basis for a far clearer picture of the cultural history of the continent. I am convinced that the data on stone artifacts have an important part to play. I hope the time is past when archæologists fail to record any information except that of which the significance is already obvious.

To conclude this discussion of terminology, it should be emphasized that the terms used here are not necessarily synonymous with their use by other authors. Such words as Pestle and Palette are restricted to somewhat specialized tools, a usage that seems preferable to applying them in a broad and general way. The multiple uses of some implements adds to the difficulty of finding suitable names, and descriptive rather than functional terms are used whenever it seemed to reduce the possibility of confusion. The general agreement that has been reached on much of the terminology for pottery[20] indicates that similar agreement would be possible on stone artifacts. When such agreements can be reached the task of studying and reporting stone objects will be greatly reduced, and more satisfactory comparative studies made possible.

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[15] McGregor, 1941, fig. 57.

[16] 1936.

[17] Knoblock, 1939.

[18] Rinaldo, 1939, 1940, 1943. Martin and Rinaldo, 1947. His failure to give full details of provenience is the most serious lack.

[19] 1946.

THE CHRONOLOGY

The stone artifacts have been classified chronologically in terms of the Pecos System, as well as typologically. The assignment to chronological periods is based on the association of the artifacts with sherds, and to a lesser extent on the architectural and dendrochronological data. It is convenient to accept the preliminary work of Mrs. H. S. Cosgrove and Dr. J. O. Brew, who made a detailed analysis in the field of nearly all the sherd material. Their findings are briefly summarized in Brew's 1941 preliminary report and in the preface to the first final report.[21] Of course, it can be argued that the more cautious procedure would be to wait until final analysis in the laboratory has been made, and the sites and portions of sites assigned as conclusively as possible to chronological and cultural positions. However, there is little chance that the preliminary findings will be greatly modified as a result of further study, and the slight adjustments that may be necessary will not, I believe, seriously affect the conclusions reached here.

It is possible to accept the chronological classification of the sites involved in our study in this manner because of the remarkably detailed framework that has slowly been built up by Southwestern archæologists. In spite of gaps and controversies, the general outlines are fairly clear, and the field studies of the Awatovi Expedition resulted in refinements rather than fundamental modifications of the overall picture. This is not the place for an evaluation of the merits of the Pecos Classification, and it is used here as an approximate and not a precise chronology. Although calendar dates have been assigned to subdivisions of the Pecos Classification, I prefer to use Basket Maker and Pueblo Periods, rather than centuries, as the pigeon-holes in which the artifacts are placed, because the dates lend an unjustified appearance of precision that I wish to avoid. Except in a few instances, we cannot be sure of the exact year in which a house was built or deserted, and estimates have a way of losing their qualifications and becoming accepted as final and precise statements.

Since the material from Awatovi is much more abundant than from the other sites, I attempted to make a somewhat finer chronological division, in the hope that trends or changes might be discerned that would not be as conspicuous in a cruder classification. This was done on the basis of a previously established sequence of pottery styles. The results of stratigraphic studies during the first three seasons at Awatovi are summarized by Brew as follows:

> During the course of this development, almost half a millenium in time, changes in pottery styles have been observed. The black-on-whites of Pueblo III give way to a black-on-orange, which is the first of the so-called Hopi colored wares. . . . After the black-on-orange comes the first true yellow, still geometric in design and varying little from the black-on-orange except in color. This style lasted but a short time and was superseded before the beginning of the 15th century by the famous Jeddito Black-on-yellow ware with beautiful designs of highly conventionalised bird and animal figures. This fashion culminated during the decades preceding the Spanish invasion in pottery generally described as the most beautiful in the Southwest, Sikyatki Polychrome. After the inauguration of extensive European influence, which probably did not take place until the establishment of the mission in 1629–30, the technical and artistic excellence of the pottery suffered, for the most part, definite and startling change . . . and new types appear which we have named San Bernardo, after the mission.[22]

Further study during the two concluding seasons substantiated this sequence, with the exception of the distinction between late prehistoric and historic. Decorative treatment is generally less precise on 17th century pottery, but some of this more carelessly executed pottery is undoubtedly of pre-Mission date. Consequently, the presence of metal and/or domestic animal bones in refuse accumulations was used to identify 17th century material for the purposes of this study, with only occasional recourse to pottery styles.

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[20] In addition to the manuals of pottery published by the Museum of Northern Arizona, the University of New Mexico and Gila Pueblo (Globe, Arizona), see also Douglas and Raynolds, 1941, Marriott, 1942 and Raynolds, 1944.

[21] Hack, 1942a.

[22] Brew, 1939, p. 105.

With the exception of the rooms dug during the 1935 season (the North-South Test Trench) when the sequence of pottery styles and the criteria for the types were being first worked out, each level of every room and test excavated at Awatovi has a sherd record, in terms of which most of the stone artifacts can be assigned relative dates. The sherd percentages show that the majority of refuse dumps accumulated without undue disturbance, and rapidly enough to represent relatively short periods of time. On the basis of the predominant or significant decorated pottery associated with the artifacts, they were assigned to seven "periods." These actually consist of the three major pottery styles plus the historic period, and three transitions between them. For convenience in this study they were named and abbreviated as follows:

P III, Black-on-white Period	B/W
P III, Black-on-white to Black-on-orange Period	W-O
P III, Black-on-orange Period	B/O
P IV, Black-on-orange to Black-on-yellow Period	O-Y
P IV, Black-on-yellow Period	B/Y
P IV, Black-on-yellow Period to 17th Century	Y-17
P V, 17th Century	17c

The criteria by which each room and level was classified are listed here in detail:

B/W. Total sherd count of black-on-white and P III reds and polychromes was twice (or more than twice) the total sherd count of black-on-orange.

W/O. Sherds of both the black-on-orange group and of the black-on-white and P III polychrome group were present, but neither group totalled as much as twice the other.

B/O. Total sherd count of black-on-orange was twice (or more than twice) the black-on-white and P III polychrome total, *and* black-on-orange sherds were also twice (or more than twice) the black-on-yellow sherds.

A few exceptions were made, in assigning to this period rooms in which black-on-white, black-on-orange and black-on-yellow sherds were present in nearly equal amounts.

O-Y. Both black-on-orange and black-on-yellow sherds were present, but neither totalled as much as twice the other. Also included were levels in which Awatovi Black-on-yellow sherds (the earliest black-on-yellow type) exceeded Jeddito Black-on-yellow sherds, thereby indicating the transition from black-on-orange to black-on-yellow wares.

B/Y. No San Bernardo Polychrome present, *and* more black-on-yellow sherds than black-on-orange, *and* more Jeddito Black-on-yellow sherds than Awatovi Black-on-yellow sherds. Sikyatki Polychrome present.

Y-17. San Bernardo Polychrome present, but less than Sikyatki Polychrome. No metal or domestic animal bones.

17c. Presence of iron or copper objects, or domestic animal bones, *or* architectural evidence, such as the fill of rooms in the Franciscan Mission or the contemporary blocks of Indian houses adjoining it on the west and north.

Artifacts were classified as "Unassigned" (abbreviated to Unsd) if they were found on the surface, if the associated sherds seemed to be disturbed or mixed, or if data were insufficient for any assignment.

In the succeeding descriptions of the artifacts, the provenience will be recorded by site, and in certain cases by chronological subdivisions of the site. Material from Sites 4 and 4A is listed as Basket Maker III-Early Pueblo I, Pueblo I-Pueblo II, Pueblo III, or Unassigned. Material from Site 264 belongs to Basket Maker III-Pueblo I, unless specifically referred to as coming from Room 42, which was Pueblo II. Material from Site 107 cannot be more finely classified pending final analysis of the pottery, although the site was occupied for a relatively long time, from Pueblo I to III. All Awatovi material is listed according to its "period" as explained above.

The relationships of the various sites, in approximate chronology, are suggested in table 2.

THE VALUE OF A STONE ARTIFACT STUDY

ITS APPLICATION IN TEMPORAL AND AREAL DISTINCTIONS

TWO of the principal goals of all archæological endeavor are the construction of chronological sequences and the delimitation of the geographical boundaries of cultures. In fact, these two aims are frequently treated as the ultimate purpose of archæological research. An impressive array of time-scales and a bewildering number of cultures, sub-cultures, "aspects," "phases," "patterns," and "foci" attest to the energy devoted to the setting up of this spatial and temporal framework. Of course, most workers in the discipline of archæology realize that this is but a first step, a necessary preliminary to the reconstruction of cultural history. The nature of the reconstuction—the interpretive phases of archæology study—will be commented on in succeeding sections of this introduction. First, we should consider the way in which the framework is established.

Customarily the first step is to discover a series of forms or styles of artifacts which are characteristic of successive periods—decades, centuries or millennia. They serve much as "index fossils" do in the recognition of geological strata. The choice of a class of objects for analysis is often based on fortuitous circumstances. Whatever has survived from the past will be chosen, whether broken dishes, discarded tools, or jewelry. There are several characteristics that a group of artifacts should possess if they are to serve as the diagnostic criteria for successive cultural periods. *First*, they must be abundant. Only when a large number of axes or fibulae or sandals or potsherds can be examined is it possible to decide what styles or "types" are truly characteristic of any particular time. Some will be unique or unusual, and it is only the forms which constantly recur that are valuable as "index fossils." *Second*, there must be successive variations, preferably gradual but frequent. An artifact whose form remains unchanged throughout countless generations may be significant from other points of view but is of no use in establishing the relative dates of associated materials. *Third*, the ease with which styles and forms may be classified often influences the choice of criteria for the time and space framework. For example, when a bewildering variety of surface decorations occurs on pottery, it may be easier to discover a progression of a few distinct shapes, each typical of a certain place and time. As their skill increases, however, archæologists are learning to make more subtle and more adequate classifications of a great variety of objects. *Fourth*, it is desirable that a group of artifacts exhibit geographical variation, but of neither too great nor too slight a degree. If the variations from place to place are too great there will be difficulty in correlating the sequences of adjoining regions. If these variations are too slight it will be difficult to work out satisfactory subdivisions of major areas. In practice, different bases are often used for setting up areal and temporal divisions.

Even if a single class of archæological remains satisfied the requirements just listed, which rarely happens, it is generally considered preferable to base a sequence on several classes of data. There is a dangerous attractiveness in simple schemes which trace cultural developments in terms of only one set of criteria. The supposed succession of basic materials—stone, copper, bronze and iron—is now recognized as an unjustified simplification for the Old World. For example, all four were often in simultaneous use and in much of Africa the use of iron was not preceded by either copper or bronze. In the best archæological work a cultural subdivision of time or space is characterized in terms of as many types of remains as possible—pottery, architecture, art styles, an assortment of implements and tools, clothing, etc. The selection of criteria is, of course, the result of intensive investigation and analysis, and no one can predict what will be found to have the greatest diagnostic value. But generally it is preferable to rely on more than a single criterion for identification of a cultural unit. The "pottery cultures" are sometimes a necessary evil in preliminary stages of research. But the pottery should be regarded as a clue to chronological or geographical relationships. The existence of "Cord-marked People" and "Black-on-white Culture" even in the technical literature, is an indication of the carelessness of much archæological language. Careless language, unfortunately, often indicates careless thinking. By itself, unsupported by additional data, a pottery sequence is a pottery sequence, never a "culture."

The first role which stone artifacts may serve, then, is in helping to formulate the criteria by which the units of the time and space framework are defined. They will sometimes be the chief reliance of the archæologist, as for the most ancient cultures of both hemispheres. Hardly anything else survives from those remote times which might serve as an "index fossil." Sometimes, stone artifacts will be virtually ignored, when it is found that other classes of material are more reliable indicators. But in most archæological frameworks, stone serves along with pottery, architecture, shell, metal, basketry, etc.

INTERPRETATION OF TECHNOLOGY, ECONOMY AND TOTAL CULTURE

The purpose of archæological study is to provide information about man's past, the history of cultures and societies. Historical studies, since they concern themselves with social systems and with the groups of men in those systems, are included within the larger domain of the Social Sciences. Archæology is essentially a *method*, employed to enable social scientists to study past cultures as well as cultures still existing or known from contemporary records. Even in the latter instance, archæological methods are valuable for supplementing the data of written records. The life of Colonial Williamsburg, of Augustan Rome, or of Early Christian Ireland is far better understood from the results of digging than it ever could have been from documents alone.

It must be remembered that *culture* means something more than the few technics and customs that sometimes represent the whole in archæological handbooks and summaries. In 1871, E. B. Tylor defined culture as ". . . that complex whole which includes knowledge, belief, art, morals, law, custom, and any other capabilities and habits acquired by man as a member of society."[1] Essentially the same thing has recently been expressed more precisely in another definition: "A culture is a historically derived system of explicit and implicit designs for living, which tends to be shared by all or by specially designated members of a group."[2] It may appear a discouraging task to try to infer "that complex whole" or a "system . . . of designs for living" from scraps of pottery and stone. Archæologists can never describe past cultures as fully or as richly as ethnographers can those of people still living. But for nearly the whole of our history the only information about the life man has led is such as can be gleaned by archæology. It is, therefore, a choice of learning what we can from these slight clues, or knowing nothing at all.

There are several serious difficulties hampering any attempts to learn of *culture* from the archæological data. First among them is the fact that only *material culture* survives, that is, the tangible remains of people's activity, such as tools and houses, or often only the scattered ashes of a campfire, a few cracked animal bones and a forgotten knife blade. It is a truism that material culture is a small portion of a whole culture. How small a fraction it is will be suggested by a glance at the table of contents of a few standard ethnographic reports. To make matters worse, the greater part of the material possessions of a group is usually lost to the archæologist through plunder, decay and the disturbance of later occupations. Roman London, for example, would be far better preserved if it had not been the foundation for subsequent centuries of building and burying, but had been abandoned like the Roman cities of Tripolitania. Also the parts of the world where moisture does not eventually destroy most organic material are not only few in number but are seldom the centers of the more complex and richly equipped pre-industrial cultures. Consequently, archæologists, perforce, must work with only a tiny fraction of a whole culture.

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[1] Tylor, 1871, p. 1.

[2] Kluckhohn and Kelly, 1945, p. 98.

Another drawback in the reconstruction of culture history from archæological data is our great ignorance concerning much of what we find. It frequently astonishes laymen to see experienced excavators rip through tons of jumbled stone or many feet of mixed pottery, bones and organic refuse. The archæologist's casual explanation, "It's too disturbed . . ." or "Redeposited midden material . . ." is really a way of saying that he does not know how to interpret the deposit and consequently prefers to look for something he does understand (such as "undisturbed refuse" or "stratified deposits"). Technics are continually being refined and each generation is appalled at the ignorance and destructiveness of its archæological predecessors. But we still have much to learn before we can interpret all the available evidence to the fullest. In cultural terms (a "system . . . of designs for living") we cannot yet say what is the full significance of such things as the choice of pottery designs, or the change from inhumation to cremation, or variations in size and shape of houses.

A difficulty in the proper interpretation of archæological data can arise from the uncritical acceptance of concepts of economic determinism. It would make the reconstruction of past social systems relatively simple if we could be sure that with each pattern or set of technical skills there were always associated certain systems of family and group organization, religious activities, etc. There is doubtless a powerful and inescapable influence of technology on every aspect of a culture.[3] Unfortunately, for the convenience of the archæologist, technology has not yet been proved to have a directive influence on institutions, rather only a limiting or permissive effect. In this it is comparable to the physical environment, with which most anthropologists have given up "correlating" cultural traits. Knowledge of the technology of a people immediately suggests that they may have had certain kinds of institutions and engaged in certain kinds of activities. Such suggestions should not be used for more than they are worth, however, as incautious speculations will bring into disrepute the sort of careful and limited interpretations that archæologists need to make.

In general, the soundest procedure will be to determine from the artifacts of a site or group of sites as much as we can concerning the technology of the people who made and used the artifacts. From a knowledge of the technology, we can then infer something of the economy, that is, the whole system of providing and managing the food, shelter, equipment and other possessions of the group. The making of generalizations about the social system or culture as a whole, on the basis of inferences of their economy, is a more perilous step. While not going beyond what the evidence will support, such generalizations ought to be attempted. They will be tentative at first, but a proper blend of imagination and discretion is possible and desirable.

The potentialities of archæological data for more than chronologies are coming to be realized by an increasing number of people. The following are among the recent important considerations of the subject:

E. C. Parsons, "Relations between ethnology and archæology in the Southwest" (1940)
J. H. Steward and F. M. Setzler, "Function and configuration in archæology" (1938)
Grahame Clarke, *Archæology and society* (1939), particularly pages 151 to 188
W. W. Taylor, "A study of archæology" (1948)
W. D. Strong, "Anthropological theory and archæological fact" (1936)
J. H. Steward, "The direct historical approach to archæology" (1942). "Ecological aspects of Southwestern society" (1937b)
A. M. Tallgren, "The method of prehistoric archæology" (1937)

There is considerable theoretical interest in two recent analyses of archæological data in terms of somewhat specialized problems. While the particular conclusions are unimportant here, these two papers indicate what critical use of the archæological data may accomplish. In "North American Cooking Pots"[4] Ralph Linton considers classes of pottery often grouped together as "utility wares" from the standpoint of their historical development and also in terms of their probable uses. By considering the suitability of certain shapes of vessel for boiling and for other methods of cooking, he reaches the conclusion that the use of pottery reflects certain cooking technics, rather than indicating "sedentary" or "agricultural" societies. He closes with a plea for realization "that the purposes for which objects are made and the ways in which they are used are quite as significant for archæological studies as the objects themselves and provide an equally valuable clue to cultural relationships." The second recent analysis is "An inquiry into supposed Mexican influence on a prehistoric 'cult' in the southern United States" by Alex D. Krieger.[5] He undertakes the difficult task of deciding from an assemblage of artifacts whether a religious cult was introduced from Mexico into the United States in late prehistoric times. The problem is one of cultural dynamics as well as comparison of traits and establishing dates. Krieger's viewpoint is indicated in this statement: "One of the fundamental precepts of archæological thinking should be that specimens are not so much objects to be classified, but the concrete, overt expression of the mental and social world in which their makers lived." The future of archæology as a technic of social science will be assured as long as such viewpoints as these are kept in mind by archæologists.

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[3] For example, Chapple and Coon state "that each stage in cultural complexity is directly dependent upon increases in the efficiency of technological activities." (Chapple and Coon, 1947, p. 258.) This appears to be a revival of L. H. Morgan's causal association of certain technological and social traits. Such an association is implicit in recent papers of Leslie A. White.

Whenever possible, it is a great help to have the material culture of surviving, derivative modern societies for comparison with the prehistoric artifacts. Used with proper caution, such comparisons can suggest the probable functions of many artifacts, as well as prevent the fantastic conclusions sometimes arrived at by "pure" speculation. Also, the arrangement of rooms and houses, details of their construction, the burial practices, and all manner of previously trivial bits of information may begin to take on greater meaning. It cannot be uncritically assumed that ancient uses of an object necessarily were the same as modern practices, much less that the attitudes now associated with it were identical in the past. Sometimes only the most tentative suggestions can be made. But often a continuity can be traced between the ancient people whose culture is being reconstructed and their modern descendants, who still carry on some of the same activities in the same way. This is true in the Jeddito district, where objects from Awatovi and other sites resemble even in minute details some of the implements and ritual equipment of the modern Hopi.

An archæologist may meet one serious difficulty in comparing his excavated material with modern cultures. With certain outstanding exceptions the literature of modern ethnography is surprisingly incomplete on technology. Current anthropological fashion has directed attention elsewhere. In some reports the inclusion of technology seems rather grudging and unenthusiastic, and in many reports it does not appear at all. Descriptions alone, without an account of who does what, and how it is done, are utterly insufficient. This should not need to be pointed out to students of contemporary societies, least of all by an archæologist. Ethnographers would do well to remember Malinowski's opinion that an object of material culture is defined by *function* rather than merely by form, by "the part which it plays within a system of human activities."[6]

In any functional applications of archæology I believe the stone artifacts are going to be very important. They are among the few classes of imperishable objects, and survive in relatively unaltered form. They are greatly diversified and generally enter into a large range of a people's activities. A list of the possible functions of Jeddito stone artifacts will be found in the concluding part of the report. Nearly every aspect of the life of the society is involved—agricultural and hunting activities, the preparation of the food so secured, house building and the minor arts and crafts involved in its furnishing, the production of clothing and its ornamentation, and the elaborate religious and ritual life that we believe occupied a great portion of the lives of the prehistoric Pueblo Indians. Pottery, in comparison, usually served a small variety of uses. The lives of primitive people certainly did not revolve around it to the extent that the lives of archæologists do. Its abundance and endless minute variation make it a splendid criterion for the archæologists' space and time frameworks. Also, it can reveal certain important aspects of past cultures, as indicated in the article by Linton mentioned above. For the most part, however, pottery was made to serve in the preparation and consumption of food, and had minor importance in only a few other activities. In great sectors of the peoples' lives it played no role at all, so that the inferences to be made from it are correspondingly limited. For the most complete interpretations, of course, every bit of evidence will be needed, and every year archæologists gain increasing skill in wringing the utmost from the data with which they have to work. From the charred wood that once merely meant a burned room dendrochronologists often can learn the approximate, and sometimes the exact date on which the room was built. Even material which the tree-ring expert finds unsatisfactory may now yield dates through the technic of Carbon 14 analysis. Recently it has been suggested that precise quantitative and qualitative analysis of the total remains of refuse heaps may give valuable information on the diet of the people responsible for the midden. Similar refinements are being made along a hundred other lines of attack.

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[4] Linton, 1944.

[5] Krieger, 1945a.

[6] Malinowski, 1931, p. 625.

The possibilities of a thoughtful use of all the data so far available are admirably indicated in a recent "popular" book, *Cliff Palace*, by Don Watson, a Southwestern archæologist on the staff of the National Park Service at Mesa Verde, Colorado. In simple and readable manner he tells the story of the daily life of the people of Mesa Verde in prehistoric times. Scrupulous regard for the archæological facts has not prevented his making the story dramatic and interesting to the layman as well as the specialist. A more technical but equally readable reconstruction of Indian life has been made by Charles A. Amsden in his *Prehistoric Southwesterners from Basket Maker to Pueblo.* Carcopino's *Daily Life in Ancient Rome* is an example of what can be accomplished by combining the evidence supplied by excavation with the documentary sources. Books like Gordon Childe's *Man Makes Himself* and *What Happened in History* are even more impressive results of the interpretation of archæological data in terms of social history. It would be well to remember, too, that such broad syntheses as Kroeber's *Configurations of Culture Growth* and Toynbee's enormously influential *A Study of History* could not have been written without the continual use of inferences from the minutiae of the material culture of past societies, brought to light all over the world by the efforts of the archæologists.

THE STUDY OF CULTURE CHANGE

Among anthropologists there is currently a great interest in the problems of culture change. There is still a continuing need for studies of human society which view culture only on a single synchronous plane. But the static picture should be supplemented by the perspective that comes from a regard for the historical continuum. Every culture changes, through such processes as diffusion, invention, acculturation, etc. Because there are few or no documentary records for most of the world's societies, the problem of supplying "time perspective" becomes to a large extent an archæological one. Even where analyses of contemporary data can produce hypotheses about historical processes, the archæologists' help is needed for validation. For example, W. D. Strong's "An analysis of Southwestern society" (1927) presents a "reconstruction" of the development of certain social institutions in the Southwestern United States. Archæological evidence supported much of his hypothesis, and his suggestions also pointed out further problems for archæologists to take up. On the other hand, in "An introduction to Nebraska archæology" (1935)[7] a promising set of hypotheses about Plains prehistory, based on the very full ethnographic data, were shown to be quite incorrect. Combining ethnological and archæological data is producing excellent results.

[7] Especially pp. 294–300, and *see also* Strong, 1933.

The traditional separation of the two has been largely a result of academic conservatism and reflects no genuine division of interests within anthropology.

One of the aspects of culture change that is frequently illustrated in archæological material is the different rate of change of various aspects of a culture. Although all the activities of a society are interrelated, some may remain virtually unchanged, or change very slowly, while others are modified with great rapidity. Social scientists are aware of the profound disharmony existing in our own society between many beliefs and institutions, rigid and slow to change, and our rapidly changing technology. There are similar disharmonies on a smaller scale in our own culture, right down to the linguistic fossils like "dashboard" for the instrument panel of an automobile, or the survival of sabres as part of military dress uniforms.

Two strikingly opposed tendencies are often conspicuous in the realm of material culture. One is the rapidity with which styles can change, and continue to change, with little or no relation to practical considerations. Although we may deplore the ingenuity of our fashion designers in concocting a "new" style for every season's dresses and every year's cars, the resultant succession of trivial changes is not greatly different from the small variations in Bronze Age fibulae in Europe or in the decorative treatments of Pueblo pottery. The possibility of periodicity in cultural change should be considered by archæologists. Because of the nature of their data, the tangible remains of human activities, studies of trends in size, proportion, and other such simple details can be made, as well as analysis of more subtle changes in technic or artistic style. It is apparent that such studies of minute chronological changes may produce valuable results and provide the basis for far-reaching conclusions. Consider Kroeber's interest in the changes in length and width of women's evening dress.[8] He states, "We have, I think, now found reasonable evidence of an underlying pulsation in the width of civilized women's skirts . . . of an analogous rhythm in skirt length. . . . There is something in these phenomena, for all their reputed arbitrariness, that resembles what we call a law: a scheme, an order on a scale not without a certain grandeur." It is easy to see in this little essay of Kroeber's the beginning of an interest in the rhythms of cultural change that culminated in his remarkable *Configurations of Culture Growth.* This important volume is full of hypotheses that deserve the consideration of all archæologists, and a critical testing with the special resources at their command.

Contrasting with this tendency of ceaseless change is the remarkable stability of certain traits. For centuries the form of a tool may remain the same, in spite of its efficiency being poor and the possibilities of improvement being (to us) obvious. When the form of an implement remains unchanged, at the expense of convenience, there may be some strong reason for this inefficient adherence to tradition. Thorstein Veblen, in *The Instinct of Workmanship,* makes some suggestions so pertinent to this problem that they are worth quoting at some length.

> This body of habitual principles and preconceptions is at the same time the medium through which experience receives those elements of information and insight on which workmanship is able to draw in contriving ways and means and turning them to account for the uses of life. And the conventional verities count in this connexion almost wholly as obstructions to workmanlike efficiency. Worldly wisdom, insight into the proprieties and expediencies of human intercourse, the scheme of tabus, consanguinities and magical efficacies, yields very little that can effectually be turned to account for technological ends. The experience gained by habituation under the stress of these other proclivities and their derivative principles is necessarily made use of in workmanship, and so enters into the texture of the technological system, but a large part of it is of very doubtful value for the purpose. Most of this experience runs at cross purposes with workmanship, not only that the putative information which this experience brings home to men has none but a putative serviceability, but also in that the habit of mind induced by its discipline obscures that insight into matter of fact that is indispensable to workmanlike efficiency.[9]

Although it would not seem easy to check such speculations as these by means of archæological data, some impressive confirmation is provided in a study by John Rinaldo, "An Analysis of

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[8] Kroeber, 1919.

[9] Veblen, 1914, p. 51.

Prehistoric Anasazi Culture Change."[10] For purposes of comparison he divides culture into several "sectors": Shelter, Household and Personal Equipment, Hunting and Food Gathering, Clothing and Ornaments, and Ceremonial. He concludes, "The Ceremonial sector might be considered the most stable because proportionately the fewest traits were modified into the fewest types in this sector." He also found that "The largest proportionate number of traits modified into new types was in the Shelter sector. . . . The Shelter sector might be considered the least stable of the sectors because proportionately more traits were modified into proportionately more types in this sector than in any other although there were not many innovations introduced into it." The inference that seems justified by Rinaldo's conclusions is that artifacts used in activities in the Ceremonial Sector remained less changed because of what Veblen calls the "conventional verities," running "at cross purposes with workmanship." Although Veblen would presumably account for any unreasonable stability of the Shelter Sector as due to the "doubtful value" of the traditional putative information, he might also point out that in this sector there is somewhat greater "insight into matter of fact" and resultant changes in technology, than in the Ceremonial Sector where tradition rules.

The foregoing quotations and discussion demonstrate the existence of promising lines of attack on certain problems in cultural dynamics and the processes of culture change. The application of historical information derived from archæological research will be but one approach to their solution. But any success in identifying and explaining the disharmonies and rhythms of growth within a culture will rely to a large extent on the time perspective that the historical approach provides. Therefore such problems will be part of the context within which archæological data may prove most useful. We can make important contributions to the whole of social science, if we wish to. As Kluckhohn says, ". . . unless archæologists treat their work quite firmly as a part of a general attempt to understand human behavior" their future will be one of futility and aimlessness. In other words, our chronologies and elaborate systems of cultures and sub-cultures must be clothed, as far as we are able, in functional descriptions which will help recreate the societies of which our potsherds and stone artifacts are but an accidental residue.

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[10] Rinaldo, 1941a.

Reworked or unfinished point	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	9	12	1	...	...	...	24
Concave-edge scraper (?)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	1	...	...	2
Chipped fragment, unclassified	...	...	2	...	...	...	...	...	...	...	...	...	...	1	...	...	...	2	...	...	...	1	4	4	9	25	...	...	...	...	48
Drill:																															
Plain shafted	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	1	...	3	3	1	...	...	...	10
Shaft widened at middle	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	3	1	...	...	...	...	5
Triangular	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4	...	2	3	...	...	...	...	9
Expanded base	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...	2	2	...	...	...	...	6
Side-notched	1	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	1	...	...	...	...	...	2	4	3	1	...	...	...	13
Flake	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3	1	1	1	...	...	...	...	6
Core	...	...	...	...	...	...	...	1	1	...	...	...	1	1	...	1	...	3	...	...	...	...	1	9	8	3	...	...	...	...	29
"Chopper"	1	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	1	...	...	1	2	2	3	1	1	...	...	...	...	13
End scraper	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	3	2	4	...	...	...	1	...	11
Unshaped flake tool:																															
Retouch on both faces	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	1	...	1	4	22	8	47	56	6	1	...	...	148
Retouch on one face	1	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	4	2	...	2	11	104	49	124	256	15	6	2	8	586
No retouch	4	4	3	...	...	...	...	2	4	...	...	...	1	...	...	2	...	5	50	...	...	2	16	18	66	121	30	...	...	7	335
Pendant	1	...	1	...	...	...	...	...	...	...	2	...	...	1	...	...	...	3	...	1	1	1	6	5	18	6	1	1	1	...	49
Bead	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	1*	...	...	...	...	...	2	...	1	4	...	...	...	...	9
Ring	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	2
Mica object	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	129	...	...	...	...	...	129
Unperforated ornament	4	...	...	...	...	...	...	1	...	...	...	2	...	...	...	1	...	2	2	...	...	2	5	7	18	11	...	...	...	...	55
Loomblock	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4	28	6	2	...	...	...	40
Carved animal	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	3	7	1	...	...	...	...	12
Incised decoration	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4	...	...	...	...	...	2	4	2	...	...	...	...	...	12
Mexican jade head	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	1
Tcamahia	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	2	2	...	4	2	12	2	...	...	...	...	25
Hoe (?)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	2	1	...	1	...	...	...	...	5
Stone ball	7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...	...	...	...	4	26	38	...	2	...	...	...	79
Stone pipe	1	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	4	1	...	...	...	...	...	7
Cooking slab	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	2	...	...	...	...	...	3	15	...	1	...	...	...	22
Weight (?) grooved or notched	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3	...	...	...	...	7	6	10	2	...	...	...	...	29
Jar lid (?)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	2	...	1	...	...	...	...	...	4
Pick (?)	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	1	2	1	2	...	...	...	...	7
Small rough cylindrical stone	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	1	...	3	3	5	11	...	3	1	...	...	...	...	28
Thick cylindrical stone	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	2	1	1	2	...	1	1	2	...	...	...	...	...	11
Slender polished cylindrical stone	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	1	1	1	2	3	...	...	...	...	9
Small tapered stone	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	4	...	...	...	...	...	7
Cupped stone	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3	4	...	...	...	...	...	7
Spindle whorl (?)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1
Fragment, unclassified	4	2	4	...	6	...	...	5	1	...	...	2	...	...	...	4	...	13	...	...	3	1	18	30	86	12	2	1	...	...	194
Artifact of unknown use	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3	11	1	...	...	...	...	15
Concretion	1	...	...	...	1	...	...	1	...	...	...	...	...	...	...	...	...	4	...	1	...	3	12	26	49	2	...	...	...	...	100
Fossil	1	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	1	...	...	...	2	4	5	3	...	...	...	...	17
Selenite, crystal and stalactite	1	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	1	1	1	1	12	6	83	4	1	...	...	...	112
Petrified wood	2	...	...	...	1	...	3	...	...	...	...	...	...	...	...	...	...	3	...	...	1	1	...	39	43	3	...	...	...	...	96
Site Totals	206	42	60	31	59	11	9	81	16	4	5	25	10	46	4	23	9	241	185	113	151	249	1188	1000	3368	981	196	13	6	18	8351

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*This was a string of over 4000 individual beads found with a burial at Site 241.

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[10] Rinaldo, 1941a.

TABLE 3: PROVENIENCE AND FREQUENCY OF JEDDITO STONE ARTIFACTS

	Basket Maker III-early Pueblo I		Pueblo I-II		P I-III	Pueblo II						Pueblo II-III			Pueblo III			Pink Arrow Pueblo III-IV	Awatovi Pueblo III			Awatovi Pueblo IV			Awatovi		Kawaika-a, Pueblo III-IV	Chakpahu, Pueblo III-IV	Kokopnyama, Pueblo III-IV	Old Shungopovi, (Pueblo IV-V ?)	Total
Site:	264	4.4A	4.4A	263	107	102	103	111	169	Rm.42 264	14,18 & 22	104	105	108	106	231	Misc.		B/W	W-O	B/O	O-Y	B/Y	Y-17	P V 17c	Unas-signed					
3/4-grooved axe:																															
Unmodified (sharp)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	3	8	3	1	1	1	...	...	18
Re-used as hammer	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5	4	32	9	1	...	...	...	51
Regrooved	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3	4	...	...	...	...	...	7
Lipped	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	1
Double-bitted	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	1
Full-grooved axe:																															
Unmodified (sharp)	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	1	1	1	...	1	2	5	2	...	...	...	...	...	14
Re-used as hammer	1	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	2	2	...	1	...	3	4	28	3	1	...	...	...	46
Regrooved	...	...	...	...	...	...	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	6	1	...	...	...	...	10
Oblique groove	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	5	...	...	...	...	...	6
Partial-spiral groove	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3	...	...	...	...	...	3
Axe fragments: unclassified	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	1	2	1	...	...	...	2	4	9	2	1	...	...	...	23
Notched axe	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1	...	2	...	1	1	5	...	...	...	...	12
3/4-grooved hammer	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1	12	1	...	...	...	...	15
Full-grooved hammer:																															
Oval	3	...	2	1	1	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	1	1	1	1	...	...	...	...	12
Spherical	...	...	...	...	...	...	1	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	2	...	...	...	...	...	4
Lipped	...	1	1	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	2	1	...	...	...	...	...	...	...	...	6
Irregular	1	...	...	2	...	...	...	...	...	...	...	...	...	1	...	...	...	2	...	...	...	...	...	1	4	2	...	...	...	...	13
Unfinished axe (?)	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Full-grooved pitted hammer	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	1
Grooved and notched mano	...	...	1	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	1	...	...	3	...	...	...	...	...	6
Notched hammer	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...	4	1	2	2	...	...	...	...	12
Troughed metate:																															
Shelf at closed end	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	3
Open at one end	1	2	1	1	...	...	...	...	...	...	...	1	...	1	...	...	...	...	...	...	...	...	1	...	...	2	...	...	...	...	10
Open at both ends	...	1	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	3
Fragment, unclassified	12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	2	2	7	1	1	...	...	...	27
Miniature	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	1	...	...	...	...	...	2
Flat metate	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	7	4	1	4	12	35	70	328	71	5	...	...	...	537
Convex-surface mano	27	4	1	...	...	...	...	...	...	1	...	...	...	...	...	...	1	...	1	...	1	1	3	...	3	2	...	...	...	...	45
Mano for flat metate:																															
Single grinding sfc.	14	9	5	2	10	4	...	3	3	1	...	3	2	4	...	3	...	27	14	13	18	25	119	93	504	40	20	...	...	...	936
2 adjoining grinding sfcs.	1	...	1	...	5	...	1	4	...	...	...	1	1	2	...	1	...	6	12	18	10	12	53	35	95	13	4	...	...	...	275
Mano for flat metate:																															
2 opposite grinding sfcs.	2	...	4	1	5	...	1	7	1	...	...	...	1	...	...	1	...	10	4	6	14	12	72	49	296	23	8	...	...	...	517
3 grinding sfcs.	...	...	1	...	5	1	...	4	...	...	...	1	...	1	...	1	...	10	8	8	17	20	64	39	107	23	9	...	...	...	319
4 grinding sfcs.	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	2	...	...	1	4	5	5	23	7	...	...	...	...	48
Unused mano	2	1	...	...	1	...	...	...	...	...	...	...	...	1	...	...	...	2	...	2	...	2	5	4	18	2	1	...	...	...	41
One-hand mano	6	3	3	2	4	2	...	6	...	...	...	2	...	6	...	2	...	14	13	5	5	12	47	34	121	7	1	...	...	...	295
Pecking stone	36	9	10	11	8	2	1	30	2	1	...	5	1	13	1	2	...	28	22	19	15	38	170	109	199	27	16	...	...	1	776
Pounding and rubbing stone	10	2	3	2	3	1	1	2	...	...	...	1	...	2	...	1	...	26	18	15	19	22	78	47	124	15	12	...	...	1	405
Pebble pounder	13	...	...	...	1	...	...	2	...	1	1	...	...	...	...	...	...	3	4	2	3	5	22	18	65	5	9	...	...	...	154
Hammerstone:																															
Cylindrical	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...	...	3	...	3	...	15	...	3	...	...	...	27
Discoidal	2	...	2	...	...	...	...	...	...	...	...	1	...	...	...	...	...	6	3	1	1	6	14	8	29	5	2	...	...	...	80
Elongated pitted	1	...	...	1	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	2	...	...	2	1	7	...	...	...	...	...	15
Paint grinding stone	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	1	2	9	43	6	1	...	...	...	64
Pestle	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	3	20	1	...	...	...	...	25
Polishing pebble	5	...	1	...	...	...	...	...	1	...	...	...	...	...	...	...	...	2	...	1	...	4	16	18	36	2	1	...	...	...	87
Unused pebble	6	...	2	...	...	...	...	3	1	...	...	...	1	...	1	...	...	5	4	...	1	7	46	36	88	4	1	...	...	...	206
Flat abrader:																															
Tabular	...	...	...	1	1	1	...	...	...	...	...	...	1	...	...	...	...	3	3	1	2	2	9	12	16	1	2	...	...	...	55
Bar-shaped	...	...	...	...	...	...	...	1	...	...	1	...	...	...	...	...	...	...	...	...	1	1	10	4	2	2	...	...	...	...	22
Irregular	...	...	...	...	1	...	...	...	...	...	...	...	...	1	...	...	...	1	...	...	...	1	3	9	3	1	...	...	...	...	20
Simple grooved abrader	14	1	3	1	...	...	...	...	...	...	...	1	...	1	...	...	...	4	2	4	6	9	72	28	19	9	10	...	...	...	184
Shaftsmoother:																															
Elongated	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	3	...	...	1	1	6	5	11	5	4	...	...	...	37
Loaf-shaped	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5	4	19	3	...	...	...	...	31
Ridged	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	1	3	11	1	...	...	...	...	17
Transversely grooved	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	2	...	1	...	...	2	1	9	1	1	1	3	...	...	...	22
Miscellaneous	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3	...	...	...	...	5	2	10	4	1	...	...	...	25
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Small tapered stone	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	4	...	...	...	...	...	7
Cupped stone	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3	4	...	...	...	...	...	7
Spindle whorl (?)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1
Fragment, unclassified	4	2	4	...	6	...	...	5	1	...	...	2	...	...	...	4	...	13	...	...	3	1	18	30	86	12	2	1	...	...	104
Artifact of unknown use	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3	11	1	...	...	...	...	15
Concretion	1	...	...	...	1	...	...	1	...	...	...	...	...	...	...	...	...	4	...	1	...	3	12	26	49	2	...	...	...	...	100
Fossil	1	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	1	...	...	...	2	4	5	3	...	...	...	...	17
Selenite, crystal and stalactite	1	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	1	1	1	1	12	6	83	4	1	...	...	...	112
Petrified wood	2	...	...	...	1	...	3	...	...	...	...	...	...	...	...	...	...	3	...	...	1	1	...	39	43	3	...	...	...	...	96
Site Totals	206	42	60	31	59	11	9	81	16	4	5	25	10	46	4	23	9	241	185	113	151	249	1188	1000	3368	981	196	13	6	18	8351

*This was a string of over 4000 individual beads found with a burial at Site 241.

PART II

Descriptions of the artifacts with discussion of origins, distribution in space and time and probable functions.

". . . Facts never speak for themselves; they must always be cross-examined."

—KLUCKHOHN AND LEIGHTON

GROOVED AND NOTCHED AXES

GENERAL REMARKS

DEFINITION OF "AXE"

A TOOL which was designed and used for chopping, and which was hafted by means of a wooden handle fitted against or into grooves or notches.

CLASSIFICATION

The usual categories of Southwestern archæologists are used here, based on the arrangement for hafting. A groove which completely encircles the axe is termed "full" and one which occupies both flat faces but only one side is called "three-quarter." Notching, the alternative to grooving, appears on only a few axes in the Jeddito collection, but the form is important because it is believed to have been in use in some parts of the Southwest prior to the invention of the full-grooved style. The few notched axes which remained in use indicate that some variation in the method of hafting was tolerated, perhaps for convenience or because notching was customary for special purposes.

A great many of the axes have been used for purposes other than chopping, to judge from their battered and blunted condition. But even though used for pounding, quarrying, stone-pecking or other rough work, these axes appear to have been made originally for chopping, because they resemble in all details of shape and groove the axes that are still sharp. Therefore, although listed as "re-used" or "modified," they are classed as axes, not as hammers.

Until the 16th century, the axes were of fairly uniform type in the Jeddito area, full-grooved, but in Pueblo IV times at Awatovi the three-quarter-grooved axe came into use. As will be pointed out at greater length below, this style of hafting probably came from the south. It is typical of the Hohokam culture in the Gila Basin. In the 17th century certain specialized methods of hafting were introduced from the Rio Grande valley of New Mexico, namely, the "oblique" groove and the "partial-spiral" groove (see discussion below). The axes of these specialized forms are described here in great detail because of their close similarity to axes of New Mexico. Detailed descriptions will also be given of certain axes that were "re-grooved." That is, a second groove was made in a slightly different position, presumably because a different location of the handle was needed to make the axe balance properly.

For convenience of description, then, the following categories are used. Some of the specializations and modifications may have little importance and are represented by very few specimens, but the data should be available for future use even if we cannot interpret them at present.

Three-quarter-grooved axes:
   1. Unmodified (i.e., still sharp)
   2. Re-used as hammers
Specialized and regrooved:
   3. Regrooved in reverse direction, with three-quarter groove
   4. Regrooved in same direction, with three-quarter groove
   5. Regrooved with full groove
   6. Lipped
   7. Double-bitted
Full-grooved axes:
   8. Unmodified
   9. Re-used as hammers
Specialized and regrooved:
   10. Regrooved, with full groove
   11. Regrooved, with three-quarter groove
   12. Oblique groove
   13. Partial-spiral groove
   14. Notched axes

NOMENCLATURE

(Adapted from Kidder[1]). Some archæologists have used the term "blade" instead of bit, but as it can also refer to a knife blade the more precise term, bit, is preferable. The terms

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[1] Kidder, 1932, p. 45.

"face" and "side" I consider the clearest way to indicate respectively the broad, nearly flat surfaces and the narrow, curved surfaces of an axe. In many axes they are not clearly demarcated, but in almost all cases the dimension from face to face is less than from side to side. The handle was in the plane of the faces. In most full-grooved axes the two sides are identical, but in three-quarter-grooved axes the inner side, which was toward the user, is flatter and straighter than the outer side. It is the inner side, of course, which is not grooved.

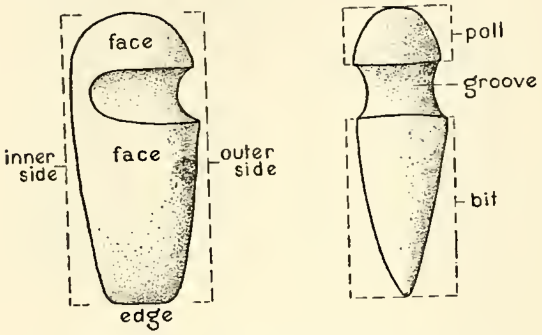

Fig. 4. Nomenclature of the Grooved Axe

HAFTING

We need not rely on conjecture for knowledge of the way axes were hafted. Both full-grooved and three-quarter-grooved axes have been found with the wooden handles still in place. The following examples indicate that a distinctly different type of handle was used on the two kinds of axe. In fact, the shape of the groove is adapted to the form of handle used, suggesting that the two methods of hafting may account for the origin of the two shapes of groove.

Canyon Creek Ruin, Arizona.[2] A three-quarter-grooved axe with wooden handle about 20 inches long. Half the thickness of the stick was cut away at one end, so that the stick could be bent around the axe head, and then tied securely. The handle is J-shaped, with ungrooved side of the axe at the opening of the J, and hence toward the user.

Verde Salt Mine, Arizona.[3] A pick, three-quarter-grooved, with a handle just like the one at Canyon Creek Ruin.

Eagle Nest House, Lion Canyon, Colorado.[4] Full-grooved axe, with handle formed by wrapping a slender stick twice around the stone. The shank of the handle is thus composed of two thicknesses of the stick. Morris states that traces of burned handles indicate that this method was used with the earliest axes in the La Plata region. It would work equally well on a notched axe. The double-wrapped method persisted, as shown by the highly specialized "spiral" groove on a few Pueblo IV and V axes.

Aztec Ruin, New Mexico.[5] Full-grooved hammer, with a handle passing twice around the groove, as in the preceding description.

Chinlee, Arizona (Site 37).[6] Full-grooved axe, just like preceding.

Cliff Palace and Spruce Tree House, Mesa Verde, Colorado.[7] Full-grooved axes, hafted like the preceding.

Mug House, Mesa Verde, Colorado.[8] Full-grooved axes with a double splint passing only *once* around the axe head. Since the stick is not looped, the portion of the groove on the inner edge would seem unnecessary, but actually, as can be seen from the illustrations, it permits the tightly bound handle to fit more snugly against the axe.

Zuñi Pueblo.[9] Apparently a full-grooved axe, with the stick forming the handle passing only once around the groove, just as in the preceding example. The handle is wrapped with buckskin. Although collected at the pueblo in 1879, there is no indication whether it was locally made there or was a souvenir brought home by a Zuñi traveller.

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[2] Haury, 1934, p. 118, pl LXXI, *f*.

[3] Morris, 1928a, pp. 86–89.

[4] Morris, 1939, p. 135, pl 151.

[5] Morris, 1919, p. 22, fig. 9, *e*.

[6] Morss, 1927, p. 39, pl VII, *b*.

[7] Fewkes, 1911a, p. 65, pl 20, and Fewkes, 1909, p. 38, fig. 12.

[8] Nordenskiold, 1893, pl xxxvi.

[9] Stevenson, 1833a, fig. 347.

THREE-QUARTER-GROOVED AXES, UNMODIFIED

Groove. (fig. 14, *a*, *b*, *g*.) On both faces and one side. Shallow, rounded, usually well smoothed. Near poll, two-thirds or three-quarters of the way from the cutting edge, except for one axe with groove at the mid-point as a result of repeated sharpening (fig. 14, *g*).

Cross-section. Asymmetric, due to flat inner side (ungrooved). Two exceptions: oval cross-section (Awatovi, P IV and P V). The two faces and the rounded outer side are generally not separated by a sharp junction, but form a continuous curve. The inner edge is more sharply separated from the sides.

Shape. Both faces of the bit curve from groove to edge, and are slightly convex from side to side. Repeated sharpening shortens the axe and would account for the stubby appearance of the shortest axes, with their conspicuous longitudinal convexity. This shortening also increases the angle at which the faces meet. Greatest width and thickness are usually on the bit just below the groove. The poll is often slightly irregular, the sides and faces rounding into each other.

Cutting edge. Slightly shorter than the maximum width of the axe, due to incurving of sides. None is flaring at the sides. Edges vary from sharp to dull, but show no serious damage.

Workmanship. Shaped by grinding and polishing, after the initial pecking. Traces of pecking still visible on several, especially on poll. Polish is generally careful, especially on the faces.

Size. Length,	mean	11.1 centimeters
	minimum	5.8 centimeters
	maximum	19.5 centimeters

A distinction has sometimes been made between long-bitted and short-bitted axes. Strictly speaking, this should apply only to those that have not been shortened by repeated sharpening. Most of the three-quarter-grooved axes described here would probably be classed as long-bitted, judging by a comparison with published illustrations. However, several are greatly worn down. It should be noted that the three-quarter-grooved axes average considerably longer than the full-grooved.

Material. Heavy, fine-textured dark igneous rock (17) and porphyritic light colored igneous rock (1). Probably obtained in basalt outcropping south of Awatovi, within 20 miles.

Provenience. (See Introduction for an explanation of the subdivisions of the Awatovi chronology, and the abbreviations used.)

Awatovi,	P IV (O-Y)	1
"	P IV (B/Y)	3
"	P IV (Y-17)	8
"	P V (17c)	3
"	Unassigned	1
Kawaika-a,	P III-IV	1
Chakpahu,	P III-IV	1
Total		18

THREE-QUARTER-GROOVED AXES, RE-USED AS HAMMERS

Groove. (fig. 14, *c*, *d*, *h*, *i*.) Same as on unmodified three-quarter-grooved axes, except for position. Due to wear of the bit, the groove is often at the mid-point and sometimes occupies half the total remaining length of the axe.

Shape. Same as unmodified three-quarter-grooved axes, but all corners and edges somewhat rounded by wear.

Cross-section. Same as unmodified three-quarter-grooved axes, except as modified toward the circular by wear.

Cutting edge. Completely worn away.

Workmanship. As far as can be determined these axes were originally as carefully shaped and polished as the others. The surfaces are battered and scarred now.

Use as hammers. Every one of these specimens was probably made for use as an axe, but at present they are greatly worn down on both ends from violent use. Besides the rough and battered surfaces that result from use in pecking stone, there are fractures and chips removed from heavy blows. Some could have been used with the handles still in place, but on others the groove is nearly obliterated. Certain other grooved tools are believed to have been originally designed as hammers or mauls; they are somewhat thicker and the faces do not converge as much as on axes. Various shapes of hammers are described below.

Size. Length,		
	mean	9.0 centimeters
	minimum	6.0 centimeters
	maximum	16.2 centimeters

The difference in length between Unmodified (sharp) and Re-used (dulled) axes is 2.1 centimeters. This amount may be regarded as the average reduction in length due to use for pounding, *if* the axes selected for this use are a random sample of all the three-quarter-grooved axes. It might be expected that the larger (and heavier) axes would be selected for re-use, in which case the average reduction would be greater than 2.1 centimeters.

Material. Heavy, dense igneous rocks, probably local (50). One axe of coarse-grained sillimanite schist, probably imported from the Rio Grande (see discussion of this material below). The axe is from Awatovi, P IV (Y-17).

Provenience.			
	Awatovi,	P IV (B/Y)	5
	"	P IV (Y-17)	4
	"	P V (17c)	32
	"	Unassigned	9
	Kawaika-a, P III-IV		1
	Total		51

All but five were from rubbish or surface. Axes were found *in situ* on the floors of Awatovi Rooms 35, 248, 403, 450 and Test 24, Room 4.

Special features. An axe from Awatovi (found on the floor of Room 248, P IV, B/Y) has one face stained with red pigment, probably hematite, apparently as the result of being used briefly as a grinding stone. The only appreciable wear, however, is from its use as a hammer.

THREE-QUARTER-GROOVED AXES, SPECIALIZED AND REGROOVED

REGROOVED IN REVERSE DIRECTION WITH THREE-QUARTER GROOVE

Figure 14, *k*.

Except for the extra groove, added later, these axes are like the normally grooved specimens. All have been worn down by re-use as hammers. A second groove, of the three-quarter form, has been pecked and ground on each of these in the reverse direction, that is, with the formerly ungrooved (inner) side now grooved. In addition, on all but one of them, the new groove is on what had been the bit, so that the ends are apparently reversed. The exception to this has the new groove placed higher up the poll, like that of the axe shown in figure 5, *c*. This regrooving is probably an indication that the axes had become so worn that the poll outweighed the bit, making them top-heavy and awkward to use. A new groove higher up, or with the axe turned over, would again give proper balance. In size and materials these axes are similar to other three-quarter-grooved axes.

Provenience.			
	Awatovi,	P IV (Y-17)	2
	"	P V (17c)	3
	Total		5

REGROOVED IN SAME DIRECTION WITH THREE-QUARTER GROOVE

Figure 14, *e*.

This axe is longer and more finely finished than the majority of the three-quarter-grooved axes, but is otherwise similar. The second groove is about 1 centimeter nearer the poll, leaving a slight shelf on the lower border of the groove. The second groove is deeper than the first, otherwise the handle would have slipped into the previous groove. Since this axe is not greatly worn down, and the edge is still sharp, the change in position of the handle probably corrects an initial mistake in its location.

Material.	Black basalt	
Provenience.	Awatovi P V (17c)	1
	Total	1

REGROOVED WITH FULL GROOVE

Figure 14, *l*.

This typical three-quarter-grooved axe has had a second groove added just below the first. However, the second groove is full, a style of hafting that had been in use for a long time in the Jeddito area when three-quarter-grooved axes began to be made or imported. From a careful examination of the axe there seems little chance that the full groove could have preceded the other. Its presence demonstrates that the older manner of hafting persisted even after three-quarter-grooved axes were in use. The full-grooved axes of the 17th century were not necessarily mere survivals or antiques.

Material. Basalt
Provenience. Awatovi, P IV (Y-17) 1
Total 1

THREE-QUARTER-GROOVED AXE, LIPPED

FIGURE 14, *f*.

This is the only axe with a pronounced protrusion of the lower border of the groove. It is uncertain whether this lipping is due to intent or to a chance result of pecking and shaping. Possibly it echoes the careful lipping which was characteristic of the earlier grooved axes of the Hohokam Culture, and which occurs in the Mimbres Phase, Mogollon Culture, on full-grooved axes. This axe has a much flatter inner side than do most of the Jeddito specimens.

Provenience. Awatovi, P V (17c) 1
Total 1

THREE-QUARTER-GROOVED, DOUBLE-BITTED

FIGURE 14, *j*.

Double-bitted axes occur sporadically in the Southwest, as variations of the single-bitted form. This axe is flat on the ungrooved (inner) side, making a strongly asymmetric cross-section. Groove at the midpoint. Both ends short. Carefully smoothed and still fairly sharp.

Material. Dark gray basalt
Provenience. Awatovi, P IV (B/Y),
floor of Room 59 1
Total 1

HISTORY OF THREE-QUARTER-GROOVED AXES IN THE SOUTHWEST

There is general agreement on the southern origin of the three-quarter-grooved axe, as far as the Southwest is concerned. Its first appearance in the Hohokam culture is in the Snaketown Phase (at the site of Snaketown) which has been assigned by Gladwin to the 8th century.[10] Sayles believes the form to be intrusive, reasoning as follows:

> The three-quarter-grooved axe made its first appearance in a specialized and highly finished form, and later developed into a more general, less elaborate type. This tendency, together with the fact that there is no known prototype for the grooved axe in the Hohokam Culture, makes it seem probable that it was intrusive from some exterior source, at present unknown.[11]

The specialized form referred to is the lip or ridge above and below the groove which disappears after the Gila Butte Phase. Farther south, in the San Simon Village, three-quarter-grooved axes appear slightly later, and are still assigned to an unknown, outside source.[12]

Mexico is commonly looked to as a probable source for traits that appear to be intrusive into the Southwest. Evidence for a southern origin of the three-quarter-grooved axe is conflicting. It is the common form of axe as far south as Zacatecas and Sinaloa and occurs rarely in Jalisco, but south of this ungrooved axes ("celts") are the common form.[13] Ekholm states that the three-quarter-grooved axe probably spread into northern or northwestern Mexico from the Southwestern United States.[14] His argument, like Sayles', rests chiefly on the lack of local antecedents. So for the present the question of a Mexican or a Southwestern United States origin seems unanswered. Gladwin,[15] however, has suggested an eastern origin, considering the grooved axe as one of a number of "Cordilleran" traits brought into the Southwest from Texas or the east coast of Mexico. Regardless of the merits of the "Cordilleran" hypothesis, it may be significant that grooved axes (generally full-grooved) occur in the early horizons of the Southeastern United States, although they did not long persist.[16]

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[10] Gladwin, 1942. A date about two centuries earlier is preferred by most Southwesternists.

[11] Sayles, 1937, p. 115.

[12] Sayles, 1945, p. 54.

[13] Kidder, 1943, p. 191; Kelly, 1945, p. 154.

[14] Ekholm, 1942, p. 107.

[15] Gladwin, 1937, p. 120.

Outside the Hohokam area, in the Southwest, the three-quarter-grooved axe appears relatively late and probably as the result of a northward spread from the Gila Basin. Rinaldo declares it to be absent in the Mogollon phases that precede the "coalescing" of Mogollon and Anasazi culture.[17] There is one possible exception which may be a tentative and unsuccessful extension from the Hohokam area or more likely from Northern Mexico. This is a three-quarter-grooved axe found at the Bear Ruin (Forestdale Phase of the Mogollon).[18] It looks more like an incompletely grooved axe than it does like other three-quarter-grooved axes, as the ungrooved edge is not flattened and the groove ends gradually instead of distinctly.

Evidence for the northward spread of three-quarter-grooved axes from the Gila basin suggests a western and an eastern route. The western route is via the Verde Valley to the Williams-Flagstaff area. In the Coconino Focus (of the Cohonina Branch) and in the Rio de Flag and succeeding Foci (of the Sinagua Branch) Colton[19] reports three-quarter-grooved axes as typical. These foci are postulated from sites to the southwest and southeast of the San Francisco Peaks, with estimated dates in the 8th to 10th centuries. However, in writing on the Sinagua Branch[20] Colton later listed three-quarter-grooved axes in only the later foci, which he assigned to the 11th to 13th centuries. They are listed as absent in earlier foci. This contradiction is probably due to rearrangement of sites within Colton's classificatory system, since about a third of the sites assigned to these foci in the 1939 report are differently assigned in the 1946 revision. The artifacts found in individual sites are not reported, so the revised foci are probably the best basis for comparison. On that basis, the three-quarter-grooved axe would be absent in the Flagstaff area until a late Pueblo II date. At this time, or in early Pueblo III times, there is believed to have been an influx of southern traits, including the ball court. Evidence for this comes from the Winona and Ridge Ruin sites[21] where three-quarter-grooved axes occurred. They are assigned to the 11th century.

Turning to the eastern route, there is evidence for the appearance of the three-quarter-grooved axe north of the Mogollon Rim and White Mountains during Pueblo I-II times, chiefly in the area around the headwaters of the Little Colorado River. At Kiatuthlanna Roberts[22] found a "few" such axes in the pit-houses of the Pueblo I horizon. They were long bitted, in contrast to the short-bitted three-quarter-grooved axes found in the pueblo ruins (Pueblo III) of the same site. At the Whitewater Ruins there were "a few" three-quarter-grooved axes, of Pueblo I-II date.[23]

Later occurrences, Pueblo III and early Pueblo IV, tend to cluster around this region, along the southern edge of the Arizona plateau. Three-quarter-grooved axes are reported from several sites near the Arizona-New Mexico line: the Village of the Great Kivas, Kinishba, Showlow, Pinedale, Kintiel, Biddahoochee and Hawikuh; and from sites further west near the headwaters of the Verde: Tuzigoot, Kings Ruin and Fitzmaurice Ruin. Of course, three-quarter-grooved axes were also in use further south, as at Canyon Creek Ruin. Further east there are very few, only at Tyuonyi and Unshagi.

At Awatovi the first appearance is in Pueblo IV, and this is probably about the northwestern limit of the spread. By this time pueblo sites further north in the Kayenta and San Juan and Mesa Verde centers were no longer populated, or had only dwindling remnants of the large Pueblo III occupation. As would be expected, at the Pueblo IV sites near Awatovi there were three-quarter-grooved axes, specificially Kawaika-a and Chakpahu. Their absence at Sikyatki, a Pueblo IV Hopi town on First Mesa, can probably be attributed to the very limited excavation there by Fewkes and lack of further work by other archæologists.[24]

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[16] Ford and Willey, 1941; Gebhard, 1946, p. 114; Webb, 1946, fig. 38, *c*.

[17] Rinaldo, 1941b, p. 12.

[18] Haury, 1940, p. 104.

[19] Colton, 1939.

[20] Colton, 1946b.

[21] McGregor, 1941.

[22] Roberts, 1931.

[23] Roberts, 1940.

When Stevenson collected museum specimens at Walpi (First Mesa) in 1879 his purchases included several three-quarter-grooved axes. It is more probable that they came from nearby sites, such as Sikyatki, than that they were made at Walpi. His collections from Rio Grande pueblos included only full-grooved axes, so the use there must have been very brief. Tyuónyi and Unshagi are considered ancestral Keres and Jemez towns, but at the modern Keres and Jemez pueblos only full-grooved axes have been seen. The three-quarter-grooved axe never reached Pecos, or, as far as we know, survived in any modern Rio Grande pueblo.

An occurrence is reported in Southwestern Colorado, at the Williford Sites[25] of Pueblo I-II. My personal opinion is that it should not be regarded as "three-quarter-grooved" since the groove is on both sides and only one face. But Rinaldo, who is familiar with the material, calls it three-quarter-grooved[26] so it may be more than a coincidental similarity to the axes of southern Arizona. Morris[27] found a single three-quarter-grooved maul in the La Plata district of northern New Mexico. Its circular cross-section suggests an unfinished full-grooved oval hammer, and it may be only an accidental approach to the southern form.

Summing up this discussion of distribution, the most significant point is the fact that the three-quarter-grooved axe gradually spread northward into the region where full-grooved axes were in use, without ever replacing them. It was used concurrently, as an alternative form. It reached as far as Awatovi on the north and the upper Rio Grande on the east by Pueblo IV, but disappeared again at the eastern limits of this spread. I believe that there can be little mechanical or technical advantage of either method of hafting over the other. However, the conservative force of tradition might induce people to continue the style to which they were accustomed, regardless of efficiency. If so, the appearance of three-quarter-grooved axes in northern Arizona and New Mexico may be the result of actual migration of people from the south. Other southern traits appear at Awatovi, mostly at a similar late period, as will be pointed out in the several sections following, as well as the concluding section. However, *ideas* can spread without any permanent shift of populations, and these three-quarter-grooved axes may be due to imitation of a "foreign" style. They were made locally, without doubt, rather than imported, and regardless of whom they were made by, reflect contact between Awatovi and southern Arizona.

FULL-GROOVED AXES, UNMODIFIED

Groove. Figure 14, *m–r*. Extends completely around axe. Usually deeper on sides than on faces. Located near poll, except for three on which it is near midpoint.

Cross-section. Two shapes. First, thick oval, tending to be rectangular, with sides of axe partly flattened. Approximately the same as cross-section of three-quarter-grooved axes, except symmetrical. Occurs on six specimens (fig. 14, *m, n, q, r*). Second, flattened oval, or lenticular. This shape not found in three-quarter-grooved axes. It is more like the cross-section of notched axes. Occurs on eight specimens (fig. 14, *o, p*). The difference is not entirely temporal, but the thick cross-section occurs earlier (Site 111, Pueblo II) and is absent in the 17th century.

Shape. Faces convex. Sides either flattened or so narrow and rounded as to be merely the junction of the two faces.

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[24] An examination of the specimens on exhibit and in storage in the U. S. National Museum disclosed very little stone material from Fewkes' and Hough's work that had not been described and illustrated in their reports. They probably left considerable "unimportant" material in the field, but published data on the artifacts they did keep seems to be quite complete. Exceptions to this are chiefly modern material, which was probably purchased as opportunity arose and seems to be described in print only when it was illustrative of special topics, as in Hough's study of pigments, or Fewkes' descriptions of altars.

[25] Martin, Lloyd and Spoehr, 1938, p. 254.

[26] Rinaldo, 1941a, p. 169.

[27] Morris, 1939, p. 137.

Cutting edge. Similar to three-quarter-grooved axes.

Workmanship. Similar to three-quarter-grooved axes, but poorer finish.

Comparison with three-quarter-grooved axes. Less uniform in shape, slightly smaller, much less carefully finished. Polls are more often irregular and rough. Chronologically, the full-grooved axe is older, but both occur in later periods.

Incised Decoration. One of the Awatovi P V axes has a small "plus" incised on one side of the bit, just below the groove. The "plus" is 0.8 centimeter wide, with the arms of equal length, not quite perpendicular to each other. Further instances of incised decorations of axes and hammers are discussed below (see Hammers).

Size. Length,		
	mean	8.7 centimeters
	minimum	6.2 centimeters
	maximum	12.1 centimeters

Material. Basalt, probably obtained from nearby outcroppings to the south. Exceptions: two specimens of fine-grained sillimanite schist, imported from the Rio Grande area. One of these (fig. 14, *o*) came from Pink Arrow, P III-IV, the other (fig. 14, *p*) from Awatovi, P V (17c).

Provenience.			
	Site 111, P II		1
	Pink Arrow, P III-IV		1
	Awatovi,	P III (B/W)	1
	”	P III (W-O)	1
	”	P IV (O-Y)	1
	”	P IV (B/Y)	2
	”	P IV (Y-17)	5
	”	P V (17c)	2
	Total		14

FULL-GROOVED AXES, RE-USED AS HAMMERS

Groove. Figure 14, *s–y*, *j'*, *k'*. Similar to the axes that are still sharp. Because of reduction of length due to wear of the bit, some grooves are relatively close to the lower end. On five specimens the grooves on the faces are partly obliterated, as a result of the axe having been used for rubbing or grinding. Their resemblance to notched axes is superficial, as careful examination reveals at least traces of a full groove on each.

Cross-section. First, thick oval, sometimes nearly rectangular due to wear of sides and faces. Thirty-five specimens. Second, thin or lenticular. Eight specimens, including seven which are probably imports from the Rio Grande, because made of sillimanite schist. Probably the thicker and heavier axes were selected for use as hammers, explaining why most of the re-used axes are of the thicker form. The sillimanite schist axes were re-used, in spite of being thin and light, because the material is extremely tough and durable.

Cutting edge. Completely worn away.

Workmanship. Apparently as good as on the unmodified axes, though the carefully shaped corners and polished surfaces are now badly damaged.

Use as hammers. As with the three-quarter-grooved axes, there is no indication that these were originally different from the axes on which a cutting edge is still preserved, except that a larger proportion of them were thick and heavy. Their use as hammers, or as pecking tools, was subsequent to use for chopping. Several still retain traces of a fine polish, and the sloping faces indicate that a cutting edge was once present.

Size. Length,		
	mean	9.5 centimeters
	minimum	5.7 centimeters
	maximum	17.1 centimeters

The average length of these worn axes is more than that of those with blade still intact, indicating that large axes were probably selected.

Material. Basalt, probably local, 36. Sillimanite schist, from Rio Grande, 9. Unidentified metamorphic rock, 1.

Provenience.			
	Site 264, BM III-early P I		1
	Site 108, P II-III		1
	Pink Arrow, P III-IV		2
	Awatovi,	P III (B/W)	2
	”	P III (B/O)	1
	”	P IV (B/Y)	3
	”	P IV (Y-17)	4
	”	P V (17c)	28
	”	Unassigned	3
	Kawaika-a, P III-IV		1
	Total		46

Notes on Provenience. One of the full-grooved re-used axes (fig. 14, *u*) was found in two pieces, the axe having been split lengthways. The smaller fragment was found in 1937, in the fill of Church 2. The other was found the next season more than 25 meters away in Room 489 of the Friary. The smaller piece had not been further worn down after breaking off, as the edges of the break were sharp. It was in refuse which probably accumulated after the destruction of the Mission in 1680. The larger piece had been further worn down after breaking. The room in which it was found was one of the small rooms built within the Friary walls by the Hopi, between 1680 and the abandonment of the pueblo, which is generally reported as occurring in the winter of 1700-01. The location of these two fragments suggests that the nave of the church was used as a refuse dump while the Indians were living in the small rooms built into the Friary.

An axe was found in the "sipapu" of a late Pueblo IV kiva (Awatovi, Test 14, Room 5). Whether placed there intentionally or not is unknown, because the "sipapu" cavity was filled with refuse of which the axe may have been a part. In this kiva there was also a cache of stone objects which was undoubtedly intentional, as they were in a recess built into the bench in the southwest corner (see carved animals, stone balls).

An axe was found on the floor of Awatovi, Room 22 (P V).

Axe used for Grinding Pigments. On the floor of Awatovi, Room 248, where a three-quarter-grooved axe with red stains was found, there was also a full-grooved axe which was worn partly flat on both faces as though from use as a grinding stone. On one of the faces was a trace of red pigment. Such use of an axe is not surprising, since after its usefulness for chopping was over and it was put to use for pounding it might occasionally be used for paint grinding, just as would any other suitably flat stone that happened to be at hand. It is well to keep constantly in mind the arbitrary nature of the classification used here. Implements designed for specific purposes were frequently put to other subsidiary uses in prehistoric times just as they are today.

FULL-GROOVED AXES, SPECIALIZED AND REGROOVED

REGROOVED WITH FULL GROOVE

Figure 14, *d'*, *e'*, *f'*.

These are like other full-grooved axes, except that a second groove was added, closer to the poll. It was probably needed because the axe was so worn down that it balanced poorly or was awkward to sharpen. In time, the angle between the faces would become too great to permit a good cutting edge, unless the entire bit was thinned and the handle shifted. This thinning has partly obliterated the first groove on these axes, but traces can still be discerned. The probable successive cross-sections, on a vertical transverse plane, of such axes are diagrammed in figure 5. Three axes were not used as hammers, their final form being indicated by figure 5, *c*. The other three were used as hammers, reaching the condition indicated in figure 5, *d*.

Material. Basalt, 2. Nephrite (?), 1. Sillimanite schist, 1, from Awatovi (Unassigned). Unidentified metamorphics, 2.

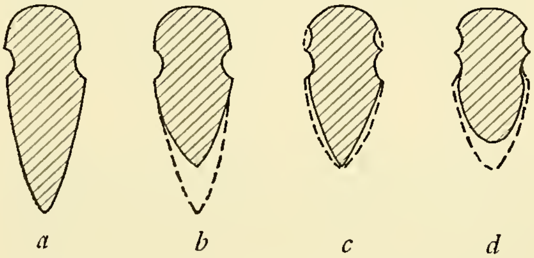

Fig. 5. Successive cross-sections of a regrooved axe.

Size. Length,	mean	9.1 centimeters
	minimum	6.4 centimeters
	maximum	12.3 centimeters
Provenience.	Site 103, P II	1
	Site 169, P II	1
	Awatovi, P IV (Y-17)	1
	" P V (17c)	2
	" Unassigned	1
	Total	6

REGROOVED WITH THREE-QUARTER GROOVE

FIGURE 14, *l'*, *m'*.

These are typical full-grooved axes, each of which was subsequently regrooved nearer the poll with a groove of the three-quarter variety, and also re-used for hammering or pounding. Since the three-quarter-groove method of hafting seems to be an introduction from the south during Pueblo IV times, these axes reflect the ascendance of the new "foreign" style over the local tradition under which they were first made. At the same time, the full-grooved method of hafting had its adherents, as was noted in commenting on the three-quarter-grooved axe which had a full groove added. Thus both methods were undoubtedly used simultaneously.

Material. Basalt, 3. Unidentified (limestone ?), 1.

Provenience.	Awatovi, P V (17c)	4
	Total	4

There is an interesting parallel at Snaketown to these regrooved axes. There, on an axe of the Santa Cruz Phase, "a full groove has been formed by reshaping an original three-quarter groove."[28] This might be an experiment, an innovation that failed to "take," or the work of a single visitor from the north who left no other trace of Puebloan influence.

OBLIQUE GROOVE

These six axes have little resemblance to each other except that on each the groove is placed obliquely instead of at the more usual right angle to the long axis. All six were re-used as hammers. Each is described individually in the following paragraphs.

Figure 14, *h'*. Shape: long, straight sided, poll rounded, Cross-section: almost rectangular, faces slightly rounded. Finish: carefully ground, but traces of pecking and several large flake scars are still visible. Groove: near poll, 3.5 centimeters wide, at angle of 70° to long axis. Inner side of groove only one-third as wide as on faces, and slanting from upper portion of groove on one face to lower portion on other. This groove is admirably suited for a handle consisting of a flexible withe making two turns around the axe. Kidder[29] has illustrated the way such an axe handle would fit. However, the distinct double groove on the faces of the axe, such as he illustrates, is absent at Awatovi. Material: basalt. Provenience: Awatovi, P V (17c).

Figure 14, *a'*. Shape and cross-section: similar to the thicker of the full-grooved axes, as far as can be determined. A considerable part of the poll is broken off, and the axe is greatly worn down by use for pounding or pecking. Groove: at 80° angle to the long axis. Much deeper on sides than on faces. Lower border of groove more oblique than upper, resulting in greater width on inner side (3.8 centimeters) than on outer side (3.2 centimeters). Groove lacks any channelling. Material: light gray igneous rock. Provenience: Awatovi, P V (17c).

Traces of an oblique groove are visible on a fragment not illustrated. The poll appears to have been partly broken away and a new groove made at a different angle, in order to use what was left of the axe. Subsequent use as a hammer further reduced both poll and bit. Material: basalt. Provenience: Awatovi, P IV (Y-17).

Figure 14, *z*. Shape and cross-section: flattened with curving sides, like the thinner of the unmodified full-grooved axes. Groove: original groove represented by traces on sides only, as subsequent grinding has removed it from faces. This groove was perpendicular to long axis. Later groove is nearer poll, which was thus reduced to a small knob 3.0 centimeters wide, as compared to a bit 5.5 centimeters wide. Groove is at about 80° angle to long axis. At upper and lower border of groove is an incised line or scratch, perhaps made in an attempt to deepen the groove. No other axe shows any such incision in the groove. Material: red and black sillimanite schist. Provenience: Awatovi, P V (17c).

Figure 14, *g'*. This axe resembles figure 14, *h'*, in size and shape. Groove: wider at inner edge (5.1 centimeters) than at outer edge (3.0 centimeters) with the lower border at 70° angle to long axis. On inner side of axe the groove has been deepened near the lower border, obliquely. Workmanship: finish is poor, with incomplete polish and considerable pecking marks visible. Poll poorly shaped, with conspicuous slope. Material: coarse-grained sillimanite schist. Provenience: Awatovi P V (17c), floor of Test 44, Room 1.

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[28] Sayles, 1937, pl. LXXVIII, *g*.

[29] Kidder, 1932, p. 51, fig. 30.

Figure 14, *b'*. Shape: straight sides, faces mostly worn away. Cross-section: thick, nearly circular. Groove: oblique groove still discernible in spite of a great deal of wear and battering. Groove deeper and narrower on one side, and sloping from face to face, as on figure 14, *b'*. Material: sillimanite schist. Provenience: Awatovi, P V (17c).

Total, oblique grooved axes: 6. Awatovi, P IV (Y-17), 1; Awatovi, P V (17c), 5.

PARTIAL-SPIRAL GROOVE

This term is applied to three axes that have the groove widened into a double channel on the outer side. It is a slight modification, but easily identifiable. At Pecos a more elaborate spiral grooving was used, and to avoid confusion with them, these are designated as partial-spirals. Kidder[30] illustrates an incompletely developed spiral groove that is similar to these.

Figure 14, *i'*. Cross-section: flattened, lenticular. Groove: slightly wider at outer side, where it is double. On inner side much deeper and only half as wide as on faces. Workmanship: finely polished, but both bit and poll worn down from use as hammer. Material: fine-grained red sillimanite schist. Provenience: Awatovi, P V (17c).

Figure 14, *c'*. Shape and cross-section: same as preceding specimen. Groove: on inner side narrower than on faces and on outer side doubled and wider than on faces. Workmanship: greatly battered but a fine polish still shows in spots. Several fragments broken off. Material: sillimanite schist, light brown. Provenience: Awatovi, P V (17c).

Another specimen, not illustrated, is somewhat doubtful, because the shallow double channel of the groove on one side may be due to regrooving. It is greatly worn by battering, much of the poll gone, and the surface subsequently smoothed as though by handling. Material: basalt. Provenience: Awatovi, P V (17c).

HISTORY OF FULL-GROOVED AXES IN THE SOUTHWEST

For the full-grooved axe there can be demonstrated a series of improvements leading from notched pebbles to the carefully shaped and finished axes of the latest prehistoric and early historic horizons. Such a series of modifications has been regarded as good evidence for the independent invention and development of the full-grooved axe in the northern part of the Southwest. Partly because the most thorough work on early sites has been done in the San Juan region, in southwestern Colorado and in southeastern Utah, the evidence appears to favor this region for a source.

According to Morris[31] no fully grooved axes have been found in the La Plata region "from the earlier periods," that is, from Basket Maker II. In Basket Maker III axes were "more frequently notched than grooved.[32] Gradually, the method of preparing the axe for hafting came to consist of a groove rather than notches. The addition of a third notch, across the end of the poll, seems to have been sporadic and never very common. Morris gives a good account of the way the change probably took place:

> While it seems clear enough that the notch was the earliest means by which a wrapped haft was attached to a cutting or pounding implement, the occurrence of notches and grooves side by side during the time from Pueblo II onward is not of marked significance. If the stone selected for an individual implement were thin, the maker usually was content with notched sides, there being little difference in actual strength or security whether the whorls of the haft lay against the faces of the stone or in shallow grooves. . . . If the stone were thicker, the continuous groove could be cut without weakening the implement. . . .[33]

At Alkali Ridge, Utah, axes with notches and with grooves were used contemporaneously, the notches more common in Pueblo I and II and grooves predominating in Pueblo III.[34]

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[30] Kidder, 1932, fig. 26, *d*.

[31] Morris, 1939, p. 135.

[32] Morris, 1939, p. 28.

[33] Morris, 1939, p. 136.

[34] Brew, 1946, p. 239.

At the Williford Sites, Colorado, (Pueblo I-II) the axes are partly notched and partly grooved, with some specimens intermediate and not easily assignable to either category.[35] Although Roberts had to write in 1930 that "no axe head has been obtained from a horizon preceding that of Pueblo I"[36] earlier axes are now known. Besides the La Plata instances mentioned above, full-grooved axes of Basket Maker III date come from Cahone Canyon, Colorado,[37] where, however, a majority (17 out of 20) were notched. At Shabik'eschee, approximately contemporary and further south in New Mexico, there were no axes, either notched or grooved.[38] Roberts remarks on their absence thus:

> Under such circumstances it is quite probable that the timbers necessary in the construction of the houses were felled and the required lengths obtained by means of fire. The butt ends of some of the timbers which were still in place in some of the ruins excavated suggested that such a method had been used.[39]

The hypothesis of an origin of full-grooved axes in the San Juan or nearby regions is somewhat weakened by their presence at Whitemound Village, near Allantown, Arizona.[40] Assigning the site a date in the late 8th century, Gladwin regards it as belonging to the Basket Maker III cultural horizon and suggests that the well made full-grooved axe is one of "the traits of the Whitemound Phase which cannot be laid at the door of the Basket Makers" (meaning, in his usage, San Juan region Basket Makers). He suggests a southern origin. The occurrence a short distance southeast at Kiatuthlanna (Pueblo I pithouses)[41] is not much help in proving this, and further south the only instances are of much later date. Mogollon Culture sites lack a grooved axe in the earlier phases, according to Rinaldo,[42] and the full-grooved axe has been considered one of the northern traits first appearing in this region in the San Francisco Phase.[43] The Mimbres area was the southern limit of the full-grooved axe in New Mexico, and it was succeeded by three-quarter-grooved axes in the later phases. This suggests the failure of the trait to survive long at the limits of its spread, something that occurred in the Rio Grande area with the brief use of three-quarter-grooved axes. Further south, in Chihuahua, the full-grooved axe appeared in the Ramos Phase as a result of the southern extension of Salado influence, an influence traceable to the Pueblo region.[44] The full-grooved axe was never used in the Hohokam Culture, except very sporadically where there were contracts with northern peoples.

In the Jeddito sites there are a few full-grooved axes before Pueblo III, but only one from the Basket Maker III-early Pueblo I horizon, at Site 264. The notched axe appears no more plentifully in the early sites, so, as Roberts suggests, fire must have been used in felling trees and cutting logs.

In northern Arizona and New Mexico the maximum geographical extent of the full-grooved axe was reached during Pueblo III and IV, extending from Pecos to Betatakin, and the most southerly occurrences reported are at Kinishba, Tuzigoot and Honanki. They were used at all the sites in this area for which we have evidence of a Pueblo III-IV occupation, although three-quarter-grooved axes were spreading into the region from the south. Full-grooved axes are absent in the Northern Periphery, that is, in Utah north of the San Juan and its tributaries, although Puebloan cultural influence has been noted far north into Utah.[45]

It is interesting that for North America as a whole the grooved axe is not a common or widespread trait. Although its presence in the Archaic Horizon of the Southeast raises the question of possible early relationships, it did not survive outside the Southwest except in limited and scattered areas. A Central American origin is improbable, although full-grooved axes have recently been reported in Guatemala.[46] In commenting on their significance, Kidder suggests that this is good evidence for independent invention, since there are no axes of this form for fully 500 miles to the north and none to the south.

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[35] Martin, Lloyd and Spoehr, 1938, p. 254.
[36] Roberts, 1930, p. 150.
[37] Rinaldo, 1939, p. 340.
[38] Roberts, 1929b, p. 134.
[39] Roberts, 1929b, p. 135.
[40] Gladwin, 1945, pp. 26 and 135.
[41] Roberts, 1931, pp. 155–56.
[42] Rinaldo, 1941b, p. 12.
[43] Nesbitt, 1938.
[44] Sayles, 1936.
[45] Steward, 1933a, pp. 16–17.
[46] Kidder, 1943.

The specialization of the groove, both the oblique and the spiral styles, probably originated in New Mexico, on the upper Rio Grande and Pecos drainages, no earlier than Pueblo IV. Relatively few such axes have been found, and the most elaborate ones (much finer in their workmanship than any at Awatovi) occurred at Pecos.[47] Spirally grooved axes have been found at Nanishagi[48] and Unshagi,[49] both of them believed to have been occupied by people ancestral to the modern Jemez, and therefore related linguistically and culturally to Pecos. Aside from Pecos, obliquely grooved axes seem to be typical only of the Pajarito Plateau[50] where they have been found in sites presumably of Pueblo IV date.

It is very likely that the oblique and partial-spiral grooved axes at Awatovi were imports from New Mexico, or imitations of such imports. Of the nine with oblique or spiral grooves five are of sillimanite schist which undoubtedly came from the Rio Grande. The other four are of basalt for which a source cannot be given. All but one have a 17th century provenience, the exception being late 16th century. The spiral groove on Awatovi axes is less carefully or completely worked out than the best of them at Pecos, although partial-spirals (as they are called here) occur on some of the less elaborate Pecos axes. The similarity is close enough to make it possible that they are the work, at Awatovi, of immigrants from the Rio Grande area. There was bitter opposition in New Mexico during the 17th century to Spanish political and religious domination. The Hopi were known for their independent spirit, and individual refugees may have fled west previous to the larger migrations at the end of the century that resulted in the founding of Payupki and Hano among the Hopi villages.[51]

There is further evidence of trade with the New Mexico pueblos in late Pueblo IV and Pueblo V in the axes of sillimanite schist found at Awatovi. Its source and some data on distribution are discussed below.

NOTCHED AXES

FIGURE 15, *o*, *r*, *s*, *v*, *w*, *x*, *y*.

Definition. Axes with two notches in opposite edges which served for holding a handle. Great variation in other details.

Notches. On ten they are pecked and on two crudely flaked. None has a third notch on the poll. Notches located at thickest part of axe, near poll.

Cross-section. Lenticular, much thinner than most grooved axes. Usually irregular because of crudity of axes.

Shape. Varies from oval to irregular. Greatest variation in shape and other features in the following four specimens: Figure 15, *s*, sides flare to a wide edge, probably an incidental result of the shape of the scrap of stone used, which shows little intentional modification in shape. Figure 15, *y*, double-bitted, with notches at midpoint and both ends sharpened by grinding. Figure 15, *o* and *r* are quite irregular, notched where surface irregularities made it most convenient.

Workmanship. Shaping mostly by percussion flaking with varying amounts of pecking and grinding, mostly at cutting edge. The apparent haste and carelessness in their manufacture contrasts with the excellence of most grooved axes. They are not crude predecessors of grooved axes, as they were made and used while grooved axes were abundant. They probably served just as efficiently for chopping, since a secure handle and sharp blade would be provided.

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[47] Kidder, 1932, pp. 45–54.

[48] Reiter, Mulloy and Blumenthal, 1940.

[49] Reiter, 1938.

[50] Hewett, 1938, and collections of Museum of New Mexico, Santa Fe.

[51] Montgomery, Smith and Brew, 1949, part 1; Fewkes, 1898a, p. 583; Reed, 1943.

Size. Length 10 to 16 centimeters, width 5 to 8 centimeters, thickness 2 to 4 centimeters.

Material. Basalt.

Provenience.		
Site 107,	P I-III	1
Awatovi,	P III (B/W)	1
"	P III (W-O)	1
"	P IV (O-Y)	2
"	P IV (Y-17)	1
"	P V (17c)	1
"	Unassigned	5
Total		12

NOTE ON SILLIMANITE SCHIST[52]

This is a complex metamorphic rock, characterized by the presence of long fibres of the rare mineral sillimanite, which are so matted and interwoven as to make the rock extremely tough. It is believed to come from a quarry, outcroppings, or stream bed boulders in the western spur of the Sangre de Cristo Mountains, lying between Picuris and Ranchos de Taos, near the Rio Grande River. This is an area of intense metamorphism and since the country is extremely rugged it has never been completely explored, even by geologists.[53] Further descriptive details of sillimanite schist are given by Kidder in "The Artifacts of Pecos." There were many axes of this material at Pecos.

There is little doubt that the sillimanite schist axes at Awatovi came from this Rio Grande region. There is probably no other source for this distinctive material. Dr. Bryan identified 19 axes as being made of this material, as follows:

Pink Arrow, P III-IV	1
Full-grooved, unmodified (figure 14, *o*)	
Awatovi, P IV (Y-17)	2
Three-quarter-grooved, re-used as hammer (not illustrated)	
Full-grooved, re-used as hammer (figure 14, *t*)	
Awatovi, P V (17c)	15
Full-grooved, unmodified (figure 14, *p*)	
Full-grooved, re-used as hammer (figure 14, *x*, *y*, *j'*, *k'*, and 4 others not illustrated)	
Full-grooved, oblique groove (figure 14, *z*, *b'*, *g'*)	
Full-grooved, partial-spiral (figure 14, *c'*, *i'*)	
Fragment, three-quarter or full-grooved (not illustrated)	
Awatovi, Unassigned	1
Full-grooved, regrooved with full groove (not illustrated)	

The relatively late date and the predominance of the full-grooved style are noteworthy. Out of the nine oblique or partial-spiral grooves five are of this imported material. The inspiration for these shapes, if not the axes themselves, is from the Rio Grande area. The three-quarter-grooved axe is not common in the area sillimanite schist comes from, although both the three-quarter groove and this material were found at Unshagi[54] and at Tyuonyi.[55] It seems probable that the Awatovi axes were imported ready-made, rather than the raw material brought in.

Sillimanite schist axes have been reported under several synonyms:[56] fibrolite, a term which is descriptive of the structure but can apply to other metamorphic rocks as well; actinolite, which is very similar in appearance but minerologically distinct; andalusite, chemically the same, but with a different crystalline structure. Amphibolite should not be used as a synonym, as it refers to a hornblende schist that is similar to sillimanite schist only in its fibrous structure.

Examination of excavated materials now stored in museums may reveal unrecognized specimens of this unique rock, which would offer valuable clues to prehistoric trade. The occurrences of which I know support the conclusions based on the Jeddito specimens, namely, that in late Pueblo IV and Pueblo V they were traded from the upper Rio Grande area.

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[52] I am indebted to the late Dr. Kirk Bryan for much of this information and for his identification of specimens.

[53] Just, 1937, describes the region briefly.

[54] Reiter, 1938, p. 165.

[55] Collections at Museum of New Mexico, Santa Fe.

[56] Hurlbut, 1946 and Northrop, 1942.

The following instances have been noted:

1) The first and still the best illustrations of "actinolite" axes are of those collected by the United States Geological Surveys West of the 100th Meridian, from San Ildefonso, Santa Clara and Taos.[57] The axes were probably picked up at nearby ruins by the inhabitants of these modern pueblos.

2) Stevenson reported its use by the Pueblo Indians of Arizona and/or New Mexico and purchased an axe at Zuñi that may be of sillimanite schist: "mottled volcanic rock, white, green and black.[58]

3) Bandelier wrote that it was a material "accessible to the Northern Tehuas, and especially to the Taos."[59] If he ever learned more concerning its source, during his painstaking studies of the Southwest, he failed to leave an account of it.

4) Hough: a full-grooved axe from Stone Axe Ruin, in the Petrified Forest (a Pueblo IV site with ceramic relations with both the Hopi and Zuñi areas).[60] Also axes from Kawaika-a and Walpi, the latter originally from one of the nearby ruins.[61]

5) Sillimanite schist axes were numerous at Pecos, particularly during Pueblo IV and V. Dr. Bryan, on examining the Awatovi axes, said most of them would be indistinguishable from those of Pecos, as far as material is concerned.

6) Gobernador area, New Mexico: two specimens, probably of the 17th or 18th century.[62]

7) Unshagi and Tyuonyi, cited above. Also Puye, Otowi and Kuaua.[63] These are all Pueblo IV towns, abandoned in the 16th and 17th centuries, and are close to the source of the material.

8) Mr. Arthur Montgomery, of the Mineralogy Department, Harvard University, showed me an "axe" of red and black sillimanite schist which was given to him by a rancher who lives near Embudo, on the Rio Grande just above the Rio Chama. The axe is smoothed but not polished and has a blunt edge showing no signs of wear. I believe it is a modern attempt to imitate a prehistoric axe. If so, it further supports Dr. Bryan's belief that the source of the material is in the vicinity of Embudo, as it was probably made from an unshaped piece of stone and not a discarded axe.

Besides its attractive coloring and texture, this material's toughness would make it a superior rock for axes. The extra difficulty of shaping it would be repaid by its resistence to fracturing and chipping. The long intertwined crystals of sillimanite, from which it derives the name fibrolite, account for this toughness. Its qualities were appreciated by the Indians, or it would not have been brought some 250 miles to Awatovi. Also, the great extent of the wear on most of the axes of sillimanite schist indicates that they were valued for stone working, even though smaller and lighter than most of the re-used axes.

CHANGE IN THE SIZE OF AXES

A comparison of axes of different periods shows a tendency for the more recent axes to be shorter, particularly those of the full-grooved form. Since there are too few axes from the earlier horizons to justify generalizations, only the axes from Pueblo III, IV and V were used as a basis for this judgment. The mean lengths in three successive periods are shown in table 4. The probable reason for the re-used axes of the full-grooved form averaging longer than the unmodified ones lies in the selection of heavier (and longer) axes for pounding and pecking. Why this did not also apply to the three-quarter-grooved axes is not known.

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[57] Putnam, 1879, pls. 17, 18, 19.

[58] Stevenson, 1883a, p. 320, fig. 349.

[59] Bandelier, 1892, p. 331.

[60] Hough, 1903, p. 322.

[61] Hough, 1903, p. 344

[62] Morris, 1939, p. 137, n. 47.

[63] Collections of Museum of New Mexico, Santa Fe.

Table 4: Mean Lengths in Centimeters of Pueblo III, IV and V Jeddito Axes

	Three-quarter-Grooved		Full-Grooved	
	Unmodified	Re-used	Unmodified	Re-used
Late P III and early P IV	13.7	8.7	11.1	10.8
Late P IV (Awatovi Y-17)	10.5	9.0	8.8	9.8
P V (Awatovi 17c)	12.8	9.4	7.6	8.9

RE-USED AXES AS EVIDENCE OF HANDEDNESS

An examination of the pounding or pecking surfaces of the axes which had been re-used (both three-quarter- and full-grooved) shows evidence of right-handedness in 32 per cent, of left-handedness in 3 per cent, and neither in 65 per cent. The evidence consists of an oblique ridge separating the two portions of the edge where wear was concentrated. If held in the right hand, the stone would tend to be tilted one way, and if held in the left hand the other way. Experiment makes it apparent which oblique ridges result from one and which from the other. The majority, with the end of the axe dulled but not ridged, were probably used with a handle, as they had been for chopping. The handle prevents the concentration of wear on one corner and also prevents turning the axe 180° on its long axis, both of which occurred on the others.

The tools that are believed to have been designed as hammers, described in a succeeding chapter, lack oblique ridges on the ends showing wear. This suggests that they were used hafted, never held directly in the hand, and further serves to distinguish them from discarded axes.

RATIO OF AXES RE-USED AS HAMMERS TO UNMODIFIED AXES

Of the full-grooved axes 79 per cent were re-used as hammers, and of the three-quarter-grooved axes 72 per cent. The later appearance in the Jeddito area of the three-quarter-grooved axes might account for the slightly smaller proportion of that form which were re-used. During the 17th century, from which the majority of Jeddito axes date, plenty of old full-grooved axes were available as hammers and pecking stones, but three-quarter-grooved axes were an innovation and less likely to have been dulled and discarded. Considerably less than a third of either group survived without being re-used.

POSITION OF THE GROOVE

In most of the unmodified axes (both three-quarter- and full-grooved) the groove is near the poll, making the blade of the axe at least twice the length of the poll.

In the unmodified axes the groove is more frequently and consistently close to the poll in the 17th century specimens than in the earlier ones. This may reflect a change in motor habits, as axes would balance differently with the change in method of hafting.

Of the axes re-used as hammers, about half have the groove midway between the ends. Since the groove is near the midpoint more frequently in the shorter re-used axes, it may be inferred that the apparent shift is partly due to the reduction in length of the blade by its use for pounding.

USE OF AXES BY THE HOPI INDIANS

Very few ethnographic data exist on which to base a discussion of the recent use of stone axes. They have not only been slowly replaced by metal axes during the last three centuries, but few ethnological and sociological observers have concerned themselves with such everyday matters. It can be assumed, I believe, that the primary purpose of stone axes was for cutting the wood needed for construction (mainly roof beams), for fuel, and for the manufacture of many small objects. The efficiency of stone axes for cutting fairly large trees has been shown by practical experiments. Earl Morris, for example, cut down and trimmed off the branches and top of a cottonwood 10 centimeters in diameter in six minutes.[64] But about half the axes used at Awatovi and the other Jeddito sites, prior to the 17th century, had been worn down by some violent use that obliterated the cutting edge. Such use greatly increased during the 17th century, and nearly all the axes were damaged and dulled.[65] The figures are as follows (combining three-quarter- and full-grooved axes, as they exhibit about the same proportions):

	pre-17th century	17th century
Sharp	25	6
Dulled	28	72

Metal axes began to replace stone in the 17th century, and would seem to have been plentiful enough to release practically all axes from wood working uses, to be put to various other uses that will be mentioned below. From the meagre historical data it appears that the Hopi continued to get iron in considerable quantities even after the Spaniards were expelled at the end of the 17th century. The Havasupai, in the 18th century, obtained their iron tools by trading with the Hopi.[66] But in 1884 Bourke reported that stone tools were still common in the western Hopi towns, although iron was replacing them.[67] Nordenskiold visited the Hopi about 10 years later and observed that the use of stone tools had ceased since Bourke's visit,[68] which is further evidence that they were in use into the latter part of the 19th century. Since then there has probably been no manufacture or use of stone axes for wood cutting.

The secondary uses of axes are for shaping stone by the pecking technic, and in ritual and traditional uses. Hough made a careful study of the various stone tools employed by the Hopi, noting that axes were found in the nearby ruins and used for shaping metates and manos and for roughening their surfaces, "the resultant misuse without sharpening, tending to reduce an axe to a form resembling that of a hammer and the hammer to a nodule."[69] At Pinedale several battered and worn axes were found with the building stones on which they had apparently been used to peck grooves as a first step in breaking and shaping.[70] Of course hammers and hammerstones were the usual tools for working stone. Similar uses were undoubtedly made of the majority of the 17th century Awatovi axes as soon as they were no longer needed for chopping. Earlier than this, with no iron or steel available, some of the axes were so used, but fewer, and probably mostly those that became too short for effective sharpening. In August 1947 I noticed at Second Mesa that steel axes undergo the same treatment. My Hopi host was using an old and very dull steel hatchet for splitting and dressing the blocks of sandstone with which he was completing his house.

"Ceremonial" use of axes is recorded by observers of the Hopi. "Archæological objects, picked up from the ruins, are valued as fetiches and are placed on the altars or employed in other ways by the secret orders. Some of these specimens have come down, apparently through many generations, in Hopi fraternities and are entrusted to individuals for safe keeping."[71] Bourke was told virtually the same thing by a Hopi: " 'The stone axes, hammers, pipes, etc. you saw in the Estufa are very very old relics of our order, and we have had them for years and years and years.' "[72] Drawings of Hopi altars show stone axes among the paraphernalia decorating them.[73] Unfortunately, we found but one axe at Awatovi under conditions suggesting that any special value might have been attached to it. This was in a kiva, in the "sipapu," the small hole in the floor said to symbolize the ancestral exit from the underworld. This axe, full-grooved and re-used as a hammer, may have been accidentally included, however, in the rubbish that filled the sipapu and the rest of the kiva after its abandonment.

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[64] Morris, 1939, p. 137.

[65] Kidder, 1932, p. 53, reports a similar condition at Pecos.

[66] Spier, 1928, based on the account of Garces.

[67] Bourke, 1884, p. 251.

[68] Nordenskiold, 1893, p. 143.

[69] Hough, 1918, pp. 270–71.

[70] Haury, 1931b, p. 53.

[71] Hough, 1918, p. 271.

[72] Bourke, 1884, p. 193.

[73] Fewkes, 1897a, p. 131, fig. 1; Parsons, 1936b, fig. 25.

There is some reason to believe that the stone axe was formerly a Hopi weapon, in addition to the spherical full-grooved hammer, which served as a war club. Beaglehole[74] carefully distinguishes them, giving the Hopi name of each. The name Titiev[75] gives for the "club or tomahawk" is similar to Beaglehole's term for the warrior's axe. In combat the War Chief traditionally carried only a stone axe[76] and the weapon is referred to as a "stone tomahawk" in Dorsey and Voth's description of the Soyal Ceremony at Oraibi.[77] In their illustrations the Chief appears to carry a double-bitted axe, or an elongated version of the spherical club (*see* Spherical Full-Grooved Hammers).

I suspect that during the last few generations, with the passing of actual warfare and the replacement of stone axes with metal ones in all practical work, there has been some blurring of the distinctions that formerly existed between war clubs and axes. For ritual purposes either would serve, and as specimens from the ruins superseded those of current manufacture former distinctions would be forgotten. There may even have been an increased regard for axes as heirlooms and altar paraphernalia, their antiquity and associations being much more important than their form. However, their absence in the Awatovi kivas is merely part of the general lack of *in situ* finds at the site, since generally each room's contents were removed to its successor. In fact, it is somewhat surprising that axes, particularly with sharp, undamaged edges, ever found their way onto rubbish heaps. The manufacture of an axe must always have been a difficult, time consuming task, particularly the grinding and polishing. It is interesting that Bourke was told by a Navaho that "in the old days" a stone axe was valuable enough to buy a wife.[78] Certainly we should consider the stone axe one of the important tools of the ancient inhabitants of the Jeddito villages, invaluable in building, and in furnishing a house, and useful also in keeping it heated; serviceable in stone working when no longer useful for cutting wood; and finally a significant piece of altar equipment as well as an occasional weapon and a potential heirloom.

POLISHING OF AXES

It may reasonably be asked why axes should be so carefully polished, beyond the apparent requirements of utility. First, a few other objects were equally well polished, so axes are not unique. A fine surface finish is characteristic of tcamahias, some pipes, a few shaft-smoothers, and of turquoise ornaments and small slender cylinders. One common feature of this group is that they were made of materials sufficiently hard and fine-grained to take a good polish. Sandstones, quartzites and basalt, so commonly used for stone objects, are rarely of textures that could have been polished. Purely as a speculation, I would suggest that to any skilled craftsman there is a temptation to exercise care and effort beyond strict necessity, particularly when the result will be esthetically pleasing. In the case of axes there is a second reason for polishing. It was necessary to grind and smooth the portion of the bit close to the cutting edge in order to make a useful tool. By merely extending the area so treated to the entire surface of the axe a very handsome object would result. Such work might be done in odd moments over a period of months or years.[79] We can infer from the crudity of some of the notched axes that when necessary a usable implement would be fashioned quickly and simply.

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[74] Beaglehole, E. and P., 1935, p. 20.

[75] Titiev, 1944, p. 161.

[76] Titiev, 1944, p. 66.

[77] Dorsey and Voth, 1901, p. 19, p. 23, pl. X, XIX, C, XXIX.

[78] Bourke, 1884, p. 69.

[79] For example, Russell (1908, p. 110) noted that the Pima would work at spare moments on the shaping of stone implements, long after they were sufficiently complete to have been put to use.

GROOVED HAMMERS AND MISCELLANEOUS HAFTED TOOLS

GENERAL REMARKS

DEFINITION OF "HAMMER"

A TOOL which was designed and used for pounding, that is, striking a blow for which a broad surface rather than a sharp edge or a point was needed. Only tools which had been hafted with a wooden handle fitted into grooves or notches have been included. Stones simply held in the hand are classified as Pecking Stones, Hammerstones, etc.

CLASSIFICATION

Like axes, the hammers can be divided into full-grooved and three-quarter-grooved. They can be disinguished from axes because the faces of a hammer do not converge toward the edge. Instead, the striking surface is broad and the faces of the implement nearly parallel. The axes which had been used for pounding, and consequently no longer had an edge, still have convergent faces from which the original shape can be visualized. The distinction is shown diagrammatically in the cross-sections of figure 6.

In addition to the two forms of groove, hammers vary considerably in shape. Some of these shapes appear intentional and recur constantly, and consequently have been made the bases for further descriptive categories ("types" if they are eventually shown to meet the requirements mentioned in the Introduction). These hammers have sometimes been called "mauls" and "clubs." Such labels imply a greater knowledge of function than we possess at present, although they may eventually be justified. Evidence for various uses of hammers will be cited in connection with the discussion of their history in the Southwest. Here, they are called hammers.

The following are the categories used for the description of the hammers from Jeddito sites. The miscellaneous group includes some unique objects, and several whose apparent multiple functions make them hard to fit into any single category.

1) Three-quarter-grooved hammers.
2) Oval full-grooved hammers.
3) Spherical full-grooved hammers.
4) Lipped full-grooved hammers.
5) Irregular full-grooved hammers.
6) Miscellaneous hafted tools, possibly hammers.

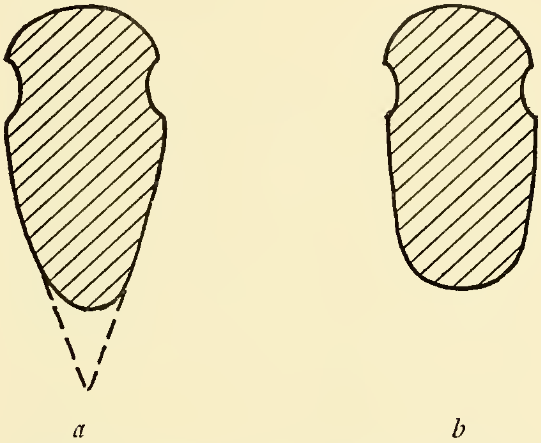

FIG. 6. Cross-sections of a re-used axe (*a*) and a hammer (*b*), showing the difference in shape.

NOMENCLATURE

The same as for axes (*see* fig. 4) except that the term "edge" is replaced by "striking surface." When it is impossible to distinguish faces from sides, because of a rounded or irregular cross-section, only the term face is used.

HAFTING

Probably the same as for axes. Because of the narrowness of the groove on some of the full-grooved hammers a single turn around the groove seems more probable than a double turn.

THREE-QUARTER-GROOVED HAMMERS

Figure 15, *a-e*.

Groove. Three-quarter style, on one side and both faces. Near poll and usually wider than the face of the poll.

Cross-section. A rounded rectangle, slightly asymmetric because the inner (ungrooved) side is flatter than the outer side. Thickness (measured from face to face) is only 1 or 2 centimeters less than width, with the exception of three quite thin hammers. In comparison, most three-quarter-grooved axes are relatively thin.

Shape. Rounded, tending to be oval rather than rectangular. The faces, though convex, are nearly parallel, instead of converging towards the blade as do the faces of both sharp and dulled axes.

Workmanship and wear. Traces of pecking visible but all have been carefully ground, and four are polished to a high gloss. The finish, as well as the shaping, is as careful as on axes. It must have been mainly esthetic in purpose, as there was no need to grind the striking surface in the way that the edge of an axe was ground. Striking surfaces are worn and roughened by use, and wear on the poll varies from slight to extreme. The poll seems to have often been used for hammering, for which it would be as suitable as the other end.

Hafting. Only one hammer shows the sort of bevelling or faceting of the striking surface that would result from using the hammer without a handle, and turning it in the hand. All others were presumably used hafted.

Special Features. Figure 15, *a*, Awatovi, Pueblo V (17c), is lipped on the lower border of the groove. Upper border is plain. There is no indication of regrooving.

Figure 15, *c*, Awatovi, Pueblo IV (B/Y), has been regrooved. Both grooves are three-quarter-type, the ungrooved side remaining the same. Later groove is 2.0 centimeters nearer poll and slightly deeper than earlier groove. Probable reason for regrooving is a desire to improve the balance in relation to the handle, either because of faulty placing of original groove or because wear has changed balance. However, many hammers are worn down much more than this one, so such factors as personal preference or industriousness may have counted.

Size.	Mean	Minimum	Maximum
Length	11.4 cm.	8.6. cm.	16.2 cm.

Material.	Basalt	10
	Quartzite	1
	Porphyry	1
	Diorite or gabbro	2
	Slate (?) with tiny black inclusions	1

Provenience.	Awatovi, P IV (B/Y)	1
	" P IV (Y-17)	1
	" P V (17c)	12
	" Unassigned	1
	Total	15

All in rubbish fill except one in wall niche of Awatovi, Test 5 (Pueblo V, 17c) with two manos. Probably used for roughening their grinding surfaces.

OVAL FULL-GROOVED HAMMERS

Figure 15, *f, k, l*.

Definition. Double ended, centrally grooved, approximately oval or subrectangular hammers. Surfaces poorly finished, unground. There is little similarity between full-grooved hammers and axes, as they differ in position of groove, cross-section and finish.

Groove. Full, completely encircling and midway between ends. Deeper than on either axes or three-quarter-grooved hammers, perhaps because the quartzite of which they are made is more easily worked than the basalt and other tough materials of axes and some of the hammers.

Cross-section. Round to oval, with the two transverse dimensions nearly the same (difference ranges from 0.8 to 1.6 centimeters). One hammer is relatively thin and three are nearly square in cross-section.

Shape. An elongated oval, tending towards subrectangular, with faces curving from groove to ends. Ends not appreciably flattened.

Workmanship and wear. Shaped by pecking, with no grinding or polishing. Surface rough and sometimes irregular. Equal wear on both ends. One exception is ground smooth. One hammer (Awatovi P IV, Y-17) was used for grinding after originally being used as a hammer; groove on one face is obliterated where surface ground flat; it is large enough to have been used as a mano, with both hands.

Size. Length,		
	mean	14.7 centimeters
	minimum	12.3 centimeters
	maximum	19.2 centimeters

Material. Quartzite, compact, dark brown, medium- to fine-grained. This quartzite was not used for any axes and for only one three-quarter-grooved hammer. The distinctiveness of the material was not a criterion in the original sorting of specimens.

Provenience.		
Site	264, BM III-early P I	3
"	4A, P I	1
"	4, P III	1
"	4A Unassigned (P I-II?)	1
"	263, P I-II	1
"	107, P I-III	1
Awatovi,	P IV (B/Y)	1
"	P IV (Y-17)	1
"	P V (17c)	1
"	Unassigned	1
Total		12

SPHERICAL FULL-GROOVED HAMMERS

Figure 15, *m*, *n*.

Definition. The term "spherical" is used for certain grooved hammers because the length and width are nearly the same. They are not, however, perfect spheres, due to small irregularities, and their cross-sections are slightly elliptical.

Groove. Fully encircling on all but one (from Site 103) on which it was about 90 per cent complete and the remaining portion pecked as though manufacture was interrupted. Grooves midway between ends.

Cross-section. Parallel to groove it is circular (3) or oval (1). Perpendicular to groove it is elliptical.

Shape. An elongated sphere.

Workmanship and wear. All are shaped by pecking, and two, of basalt, are ground also. Grinding on the other two, of quartzite, would have been ineffectual in improving appearance, due to coarse texture. Little evidence of wear, so they were probably not used in the stone-working.

Decoration. Figure 15, *m* (Awatovi, Pueblo V, 17c) has incised on it 13 short parallel lines, perpendicular to the groove and adjacent to it. This may be significant, because there is a similar "decoration" on a full-grooved axe from Biddahoochee[1] (probably Pueblo IV), 35 miles north of Holbrook, which consists of four short lines perpendicular to the groove. At Chevlon,[2] a Pueblo IV site 15 miles south of Winslow, there was found a double-bitted axe with four short incised lines parallel to the groove and an incised "X" or plus sign. The presence of a small incised "plus" on a full-grooved axe at Awatovi (Pueblo V) has already been mentioned. These markings would be of little interest except for the confirmation they may offer for the theory that these implements were war clubs.[3] Short parallel lines were carved by the Hopi along trails as tallies of slain enemies,[4] so it would not be impossible for them to have been used similarly on war clubs.

Size. Length,		
	mean	8.0 centimeters
	minimum	7.6 centimeters
	maximum	8.5 centimeters

Material.		
Basalt	2	(Site 103 and Awatovi)
Quartzite	2	(Site 106 and Awatovi)

The quartzite is a dark brown, medium-grained material.

Provenience.		
Site 103,	P II	1
Site 106,	P III	1
Awatovi,	P V (17c)	2
Total		4

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[1] Hough, 1903, p. 331, pl. 81, fig. 4.

[2] Fewkes, 1898b, p. 537, pl. xlvii. In a later report this specimen is referred to as coming from Homolovi, probably an error (Fewkes, 1904, p. 102, fig. 66).

[3] The use of clubs as a weapon of the Hopi is reported by Beaglehole, E. and P., 1935, p. 20.

[4] Titiev, 1944, p. 156; Parsons, 1936a, fig. 84.

LIPPED FULL-GROOVED HAMMERS

Figure 18, *g-i*.

Groove. Fully encircling, bordered by a pronounced lip or ridge both above and below. On hammers with circular cross-section the lips are completely encircling and on those with oval cross-section lips are limited to narrower sides. Groove midway between ends. Grooves deeper than on any other group of hafted axes or hammers, mean depth 1.3 centimeters.

Cross-section. Round to oval. Two hammers have flat surfaces produced by using them for rubbing or grinding, apparently subsequent to their shaping and use as hammers.

Shape. Oval. Ends and faces round into each other.

Workmanship and wear. Shaped by pecking, one also ground. Both ends appear equally worn, none greatly.

Size. Length,	mean	15.3 centimeters
	minimum	13.6 centimeters
	maximum	18.1 centimeters

Material. Quartzite. A gray to brown material, compact and well cemented, of fine to coarse texture.

Provenience.	Site 4A, BM III-early P I	1
	" 4A Unassigned (P I-II ?)	1
	" 111, P II	1
	Awatovi, P III (B/O)	2
	" P III (O-Y)	1
	Total	6

IRREGULAR FULL-GROOVED HAMMERS

Figure 15, *g-j*.

Description. Irregular pieces of stone, prepared for hafting by means of a full encircling groove midway between the ends. No effort had been made to peck the rest of the surface into a regular shape, although there was a fairly careful selection of pebbles and rough stones. Aside from esthetic considerations, they appear just as satisfactory for pounding, pecking or clubbing as the more symmetrical and finely finished hammers.

Additional details. Not fully conforming to the above description are the following:

Figure 15, *j* (Awatovi Unassigned), an elongated waterworn stone of fine-grained red quartzite, with a very shallow groove pecked around the center. Ends not worn, so specimen is probably unfinished and was never used.

Hammer not illustrated (Awatovi, Pueblo V, 17c), small flat rubbing stone, 9.8 centimeters long, with groove pecked around it as though for hafting. Both faces worn smooth and striated transversely. Ends battered, as though from pounding.

Hammer not illustrated (Awatovi, Pueblo V, 17c), incomplete groove pecked in two sides and half of other two sides. Ends worn as though used without being completed. Length 12.0 centimeters.

Figure 15, *g* (Site 264), fragment of full-grooved hammer, used after breaking. Groove near one end, and at 80° angle to long axis. Surface irregular but ground all over.

Provenience.	Site 264, BM III-early P I	1
	" 263, P I-II	2
	" 108, P II-III	1
	Pink Arrow, P III-IV	2
	Awatovi, P IV (Y-17)	1
	" P V (17c)	4
	" Unassigned	2
	Total	13

MISCELLANEOUS HAFTED TOOLS, POSSIBLY HAMMERS

UNFINISHED AXE (?)

Figure 15, *q*, elliptical shape, with lenticular cross-section. Shaped by percussion flaking and a small amount of pecking. Notched on sides by pecking. Poll and blade terminate in sharp edge, sinuous because of coarse flaking. No signs of use on edge, and appears unsuited for chopping without considerable further work. Similar objects are sometimes called chipped axes or hoes. Material, igneous rock. Provenience, Site 263, P I-II.

FULL-GROOVED PITTED HAMMER

Full groove midway between ends. Cross-section a thick oval. Shape oval. Both faces contain irregular pits about twice the width of the groove and slightly deeper than it, obliterating part of groove on the faces. These pits are like those on pitted hammerstones, and may have been added to this hammer so that it could conveniently be held in the fingers, subsequent to its use hafted. Size, 8.5 by 6.7 by 5.1 centimeters. Material, fine-grained red sandstone, apparently subjected to intense heat, as it is now crumbly. Provenience, Awatovi P V (17c).

GROOVED AND NOTCHED MANOS

Figure 15, *t, u.* Included with hafted tools because the grooves and notches were probably pecked in them in order to secure a handle. They probably served as hammers, as the ends are worn and battered. Three have incomplete grooves, limited to the rounded surfaces and absent on the grinding surface. Three have notches in the two edges.

Size. Length 14 to 19 centimeters.

Material. Quartzite (5) and basalt (1).

Provenience.	Site 4A, P I-II	1
	Site 104, P II-III	1
	Awatovi, P IV (O-Y)	1
	Awatovi, P V (17c)	3
	Total	6

A very similar implement is reported from a Pueblo II site at Wingate, east of Gallup, New Mexico: "A mano had been notched on the sides, and may have been used as a maul."[5]

There is almost no class of artifacts of which some have not been re-used for other purposes. When the re-use involved such conspicuous modification as the pecking of notches or a groove in what had been a mano we can infer approximately what happened. But many tools were not so drastically changed, although used for more than one purpose. It is well to keep constantly in mind that our classifications are arbitrary, and imposed for convenience, and seldom tell the whole story of the appearance and past uses of an object.

NOTCHED HAMMERS

Figure 15, *p*, and figure 18, *j, k, l.* These are irregular pieces of stone in which notches have been pecked in such positions that hafting would be possible. One or both ends are worn down by use, but only slight amounts of pecking or grinding have been attempted on the rest of the surface. There are flat surfaces on two resulting from a temporary use for rubbing or grinding. They are distinguished from notched and grooved weights by their relatively wide notches, tougher materials and worn ends.

The largest of these notched hammers (fig. 18, *k*) was found on the surface at Awatovi. Roughly triangular in cross-section, it has deep notches pecked in the three edges. Length 28 centimeters. Ends are extensively worn and rounded. When hafted it would have been a powerful tool, but its great size and weight make a different hafting method probable. A flexible withe or thong looped around it and extending over one end would have permitted it to be used with a vertical, pile-driver motion, rather than swung like a hammer. It may have served for breaking building stone or removing the overburden in open face coal mining.[6]

Size of other hammers. Length 9 to 16 centimeters.

Material. Basalt (10), quartzite (2).

Provenience.	Site 107,	P I-III	1
	Awatovi,	P III (B/W)	1
	"	P III (B/O)	1
	"	P IV (B/Y)	4
	"	P IV (Y-17)	1
	"	P V (17c)	2
	"	Unassigned	2
	Total		12

HISTORY OF GROOVED HAMMERS IN THE SOUTHWEST

Generally speaking, three-quarter-grooved hammers were used concurrently with three-quarter-grooved axes. It is impossible to tell from most published reports which is meant, since axes that were later blunted and worn down by use as hammers are usually simply listed as mauls or hammers. Unequivocal reports are few, and most tools listed as three-quarter-grooved hammers may be re-used axes. At the Bear Ruin[7] (Forestdale Phase, Mogollon Culture, approximately contemporary with Basket Maker III) there were three-quarter-grooved hammers, possibly the earliest in the Southwest. The first three-quarter-grooved hammers from a Hohokam site are reported at Snaketown, Colonial Period or possibly earlier.[8] The few other instances indicate a gradual spread northward from the Hohokam, along with three-quarter-grooved axes. In the Jeddito district both appeared in Pueblo IV times.

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[5] Gladwin, 1945, p. 58, pl. XXX, *c.*

[6] *See* description of Hopi coal-mining in Hack, 1942b.

Full-grooved hammers are more plentiful in the Southwest. They appear early both in the Pueblo and Mogollon Cultures, generally of what is termed here the oval form. The following instances are the first noted in various parts of the Southwest, all of them oval full-grooved hammers:

Alkali Ridge, Basket Maker III
La Plata District, Basket Maker III-Pueblo I
Marsh Pass, Segi Canyon, Basket Maker III
SU Site, Pinelawn Phase (contemporary with Basket Maker II ?)
Shabikeschee Village, Basket Maker III
Kiatuthlanna Pithouses, Pueblo I
Piedra District, Pueblo I-early Pueblo II

They are entirely absent in the Hohokam. Such hammers continued in use almost unchanged into Pueblo V. In the Jeddito district, for example, the dozen hammers span the entire period from Basket Maker III to the 17th century. In many places the earliest examples are simply pebbles of suitable shape, grooved for hafting. Notches are less common than grooves, and when present often seem to be the result of careless work or of the irregular shape of the stone used. This seems to apply to both the irregular grooved hammers and the notched hammers of the Jeddito region, which would represent, then, merely the poorest workmanship in a large variety of hafted hammers. Those of the finest workmanship would be the oval hammers.

Lipped full-grooved hammers came from Jeddito sites of Basket Maker II to Pueblo V dates. Similar hammers are reported from two other northern Arizona sites: RB 568, Marsh Pass Pueblo III,[9] and Navaho National Monument sites of unknown dates.[10] Rinaldo has said that "full-grooved mauls with a ridge bordering the groove are found on late Pueblo sites of the Classic and Regressive Pueblo period,"[11] (that is, Pueblo III and IV). But the evidence is scanty and any exact distribution in either space or time cannot be defined until more information is available. The lipping characteristic of the earlier Hohokam axes might be the source of lipped hammers in Classic Mimbres, as well as of Mimbres three-quarter-grooved hammers.[12]

Spherical full-grooved hammers are more likely to have served as war clubs, or as hunting clubs, than are any of the other types of grooved hammer. Hopi tradition regards the club and axe as the principal weapons for hand to hand fighting,[13] and as recently as 1840 the Oraibis killed a Navaho "with arrows and stone tomahawk."[14] A "nodule club" is Stephen's way of describing it, but there are no details and his only illustration is difficult to interpret.[15] He could be referring to a buckskin wrapped stone ball instead of a grooved club. Oraibi war clubs of the 1890's are illustrated by Dorsey and Voth. They are elongated, flattened stones, centrally grooved, with a short handle, and are referred to as stone "tomahawks."[16] Reference has already been made, in describing the short incised lines on one of the Awatovi spherical grooved hammers, to the possibilities that these are tallies. If so, this is strong corroboration for the theory that the implement is a war club.

At Pecos a spherical grooved "club" was found in the grave of a man who had died of arrow wounds, and so was presumably a warrior. Kidder cites this as strongly suggestive that the 19 such artifacts at Pecos are war clubs.[17] The shorter ones closely resemble those from the Jeddito sites. Such hammers or clubs are not numerous in the Southwest, to judge from published data, but occur as early as Basket Maker III at Whitemound Village in eastern Arizona.[18] Somewhat cruder hammers of this short stubby type were found in Segi sites of about the same period.[19] At Wingate, New Mexico, a practically spherical hammer was found in a Pueblo II site.[20] As Morris has pointed out, such small implements would make excellent weapons, but would be inadequate for such work as pounding stakes or breaking and dressing building stone. Although what ethnographic data there are suggest the possibility of use as war clubs, additional data on the actual forms of Pueblo war clubs would offer a better basis from which to appraise the archæological specimens.

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[7] Haury, 1940, p. 103, fig. 36, *e*.

[8] Sayles, 1937, p. 107, Pl. XLII, *e*.

[9] Beals, Brainerd and Smith, 1945, pp. 76–79, fig. 16, *e*.

[10] Fewkes, 1911b, p. 30.

[11] Rinaldo, 1941a, pp. 176–78.

[12] Cosgrove, 1932, pls. 39, 40.

[13] Beaglehole, E. and P., 1935, p. 20. Parsons 1936b, pp. 98, 483, 714. Hough's contrary statement (1918, p. 289) is certainly mistaken, although on most matters he is extremely reliable.

[14] Parsons, 1936b, p. 1002.

[15] Parsons, 1936b, p. 87, fig. 61.

[16] Dorsey and Voth, 1901, pp. 19, 23, pls. 10, 19 *c*, 29.

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[17] Kidder, 1932, pp. 55–56, fig. 32.

[18] Gladwin, 1945, p. 26, pl. XVI, *a*.

[19] Guernsey, 1931, p. 83, pl. 128, *b*.

[20] Gladwin, 1945, p. 58, pl. XXX, *a*.

METATES

GENERAL REMARKS

DEFINITION

A STONE slab on which food has been ground by means of a smaller upper stone. The grinding motion is reciprocal (back and forth) and not rotary or in varying directions.

CLASSIFICATION

There are a number of differences among metates resulting from slight changes in the way in which they were made and used. While the differences may have had little effect on the quality of corn meal that was produced, they show that there was a gradual specialization of the grinding apparatus from a rough slab, lying on the floor, to the modern Pueblo grinding bins, with carefully prepared stones installed in permanent positions. The principal change has been from a metate with a concave or troughed grinding surface to one with a nearly flat surface. The first is produced by using a mano, or handstone, shorter than the metate's width. The second results from a mano long enough to wear down the slab uniformly over its entire width. The troughed form is older in the Southwest and was gradually replaced by flat metates in Pueblo I to III times.

The *troughed metates* can be divided into three groups: (1) scoop-shaped, with the trough closed at one end, (2) scoop-shaped, with a secondary depression or small shelf at the closed end, sometimes called the "Utah type," and (3) trough open at both ends. The "Utah type" was found in the Jeddito district and has also been reported from an early Mogollon horizon, but seems to be rather rare outside Utah. Most of the Jeddito troughed metates were of the first type, with trough closed at one end. The third type is most common in the Gila-Salt basin, in sites of the Hohokam culture.

The metates with a plain surface, not troughed, are called *flat metates* here. Actually there are few that are perfectly flat, because wear is greatest at the center of the stroke, resulting in varying amounts of longitudinal concavity. These are called "slab metates" by Bartlett and others, but the term is confusing because many stone grinding slabs were not metates, although some sort of grinding was done on them. Furthermore, the term "slab metate" has been used in a quite different sense, so that the term is now ambiguous.

"SLAB METATE"

Morris[1] uses this term for a metate that was troughed, but much thinner than most troughed metates. He believes they came into use in the La Plata District in Pueblo I, for ceremonial use only, and continued into Pueblo III. They are more fragile and better shaped than the metates he regards as designed for everyday use. In the Jeddito material no such distinction could be made in troughed metates, and the term is not used here.

"BASIN METATE"

This term was at first used in the field to refer to large slabs which appeared to have been worn down by rotary grinding. A study of the metates, as work progressed, showed that it was very difficult to draw a satisfactory line between the larger slabs used for paint grinding and the "basin metates." Differences in size did not seem to be accompanied by any other consistent differences. Krieger has recently proposed that the term be dropped.

> Over vast areas of America a grinding process was used by many tribes who had no knowledge of corn grinding, but who used a simple, unshaped flat stone for a platform and any convenient stream pebble for a hand stone in order to smash and grind seeds, berries, bulbs, etc. This was known to American natives before agriculture and corn grinding appeared. Corn grinding . . . involved a back-and-forth motion on a fairly flat slab or with a rectangular depression in which the mano was pushed back and forth. . . . At the

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[1] Morris, 1939, p. 133.

> Third Round Table Conference in Mexico City in the summer of 1943 it was generally agreed that the term "metate" should be applied only to the corn grinding implement of roughly rectangular shape and a back-and-forth motion with either one or two-hand mano. The simple unshaped slabs in which round or oval basins are worn by a rotary motion should, accordingly, not be called "metates" at all, but by some such term as "seed slab."[2]

The problem is complicated by another factor: the fact that the prototype of the metate was probably a slab with a basin-shaped depression, and in the earlier horizons in the Southwest it is especially important that the distinction be made as accurately as possible. Following Krieger's suggestion, several "basin metates" from Awatovi and other Jeddito sites were transferred to the category *grinding slabs*, under which they are described in a latter section of this report.

NOMENCLATURE

"Grinding surface" refers to the part of the metate actually worn down by use. On some troughed metates it is a small part of the entire upper surface. Troughed metates on which the trough extends only part of the slab's length are spoken of as having an "open" and a "closed" end. The closed end was towards the person grinding, and is therefore sometimes called the "near" end. On other metates the near end can only be determined if the metate is found *in situ,* ready for use, in which case it is always higher than the other end.

TROUGHED METATES WITH SHELF AT CLOSED END

Figure 16, *a, b.*

Description. An irregular slab with part of the surface occupied by a scoop-shaped grinding surface which has resulted from a stroke that began a little bit short of the nearer end and extended all the way to the far end. At the closed end of the grinding surface is a small platform or shelf about the size of a mano. (*See* additional details below.)

Size. Length 36 to 50 centimeters
Width 26 to 45 centimeters
Thickness 11 to 15 centimeters

Material.	Coarse-grained sandstone	2
	Fine-grained sandstone	1
Provenience.	Site 264, BM III-early P I	2
	Awatovi, P IV (O-Y)	1
	Total	3

Additional Details.

Site 264, Room 19 (fig. 16, *b*). Metate made from irregular oval slab of coarse-grained sandstone, partly shaped by pecking. Grinding surface has sloping sides and rounded bottom; deepest point 5.0 centimeters below end and 4.3 centimeters below sides. Grinding surface has been roughened by pecking. Platform at near end is about 10 centimeters wide, 4 centimeters above grinding surface from which it is separated by sloping area. Platform pecked out, leaving low ridge along end of slab; no evidence of use for grinding. Although it might have served to hold mano, the space would have served as well without special shaping. Size of metate: 50 by 45 by 11 centimeters. Provenience: resting on floor in center of room, with a small amount of adobe under it. Horizontal, long axis north-south, closed end north. Mano lying nearby fits grinding surface. Possibly in place for use, but it would be unusual for it to be used horizontal. Room 19 is a small slab-walled room in a series of such rooms lying just northwest of a large pit-house (Room 16). Floor just slightly below surface of ground. No other artifacts in room; no floor features. White stain on metate's grinding surface probably a deposit by ground-water.

Site 264, Room 16 (fig. 7, *a*, and 16, *a*). Metate very similar to the one in Room 19, but better shaped, approximately ovoid. Grinding surface slightly flattened but sides and end slope; deepest point is 6 centimeters below sides. Platform at closed end is bordered by low ridge on three sides; no evidence that it was used as grinding surface. Size: 50 by 37 by 14 centimeters. Material: coarse-grained sandstone. Provenience: leaning against west wall of main chamber of pithouse, where wall is joined by partition which closes off southern recess. Its grinding surface was against wall, closed end up. This pithouse had, besides the small southern recess or anteroom, a section of the main room marked off by a low slab partition. In this area was the metate, which may indicate that the section was specially designated for women's activities or food preparation.

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[2] Krieger, 1945b, p. 51.

Awatovi, Room 243 (metate not illustrated). Similar to preceding but less even on sides and bottom. Grinding surface worn smooth; lowest point 3.7 centimeters below sides. Platform at closed end ground smooth, about 0.4 centimeter deep, size 6 by 12 approximately oval. Size of metate: 36 by 26 by 15 centimeters. Material: fine-grained yellow sandstone. Provenience: used as building stone in the plug filling a T-shaped door in west wall of Room 243. The wall was probably built not long before the Pueblo IV pottery in its fill had been in use. This shape of metate had probably long since gone out of use, and probably was picked up as material for masonry, from some small ruin nearby. Curiously, the plug of the door also contained a whole and a fragmentary flat metate.

TROUGHED METATES OPEN AT ONE END

Figure 16, *c*.

Description. A slab with grinding surface less than the full length and width of slab. Different from preceding in absence of platform at closed end.

Shape and workmanship. Mostly made of irregular and poorly shaped blocks, pecked to the desired size but not shaped. Most of slabs are larger than those used for metates with trough open at both ends. Ridge around sides and end varies from 4 to 10 centimeters wide, and sometimes more at end.

Grinding surface. Slopes down from point on upper face of slab near one end, to limit of other end, resulting in a scoop or shovel shape. Amount of wear varies, so depth of grinding surface below sides is 1.0 to 9.0 centimeters. One metate has grinding surface skewed off long axis about 20°.

Wear. Trough worn to within 1 or 2 centimeters of the bottom in thinnest metates. Others broke before this much wear, or were discarded. Since these metates were not plastered into a fixed position, but propped up for use, there would be many chances for accidental breakage when moving them. None appears to be "killed," or intentionally broken.

Size.	Mean	Maximum	Minimum
Length	48 cm.	54 cm.	41 cm.
Width	31 cm.	37 cm.	25 cm.
Thickness	9 cm.	16 cm.	5 cm.

Material.		
	Fine-grained sandstone	5
	Medium-grained sandstone	1
	Coarse-grained sandstone	2
	Quartzite (Sites 263 and 264)	2

Provenience.		
	Site 264, BM III-early P I	1
	Site 4A, BM III-P I	2
	Site 4A, P II	1
	Site 104, P II-III	1
	Site 108, P II-III	1
	Site 263, P I-II	1
	Awatovi, P IV (B/Y)	1
	" Unassigned	2
	Total	10

Additional Details.

Site 4A, Room 18 (BM III). One metate (fig. 16, *c*) upside down just west of central fireplace, the other along side it a little further west and right side up. Both on floor. Between second metate and wall stood two plain globular jars. First metate of fine-grained sandstone, second of medium-grained. Second worn more than first. No manos with them, but two on floor elsewhere in room.

Site 4A, Room 21 (P II). On floor. No other indications that it was where it belonged for use.

Site 104, Room 2 (P II-III). On floor. Also a grinding slab on floor of room. No manos or other implements.

TROUGHED METATES OPEN AT BOTH ENDS

Description. Slab with grinding surface a little less than full width but extending full length of slab. Grinding surface flatter than in metates with only one end of trough open. Bordered by ridge 1 to 4 centimeters wide. Slabs are pecked to rounded-rectangular shape, but less regular than most of flat metates. Unfortunately we neglected to ship any of these metates to Peabody Museum, and the photograph taken in the field is unsatisfactory for reproduction.

Size. One metate (from Site 111) complete: 47 by 33 by 8 centimeters. Others are 28 and 26 centimeters wide, 5 and 11 centimeters thick.

Material. Fine-grained sandstone.

Provenience.	Site 4A, BM III-P I	1
	Site 111, P II	1
	Awatovi, P IV (B/Y)	1
	Total	3

Additional Details.

Site 4A. Metate on floor of latest of the BM III pithouses, Room 24. Unusually thin (4.7 centimeters) and would require a mano longer and flatter than any found at the site. One edge and end of metate missing.

Site 111. Metate just above floor of Room 5. In cross-section the ridges along both sides are "terraced" as though wear had been in three successive stages, each time with a slightly shorter mano. No other metates at site.

Awatovi. Fragment in rubbish fill.

TROUGHED METATE FRAGMENTS

Description. Too fragmentary to determine what sort of trough was present. Probably include all three forms of trough described above, but none show the flat grinding surface and narrow bordering ridge noticed on metates with trough open at both ends.

Size. Too incomplete for satisfactory measurements.

Material.	Fine-grained sandstone	10
	Medium-grained sandstone	4
	Coarse-grained sandstone	6
	Quartzite	3
	Basalt	2

Provenience.	Site 264,	BM III-early P I	12
	Awatovi,	P IV (O-Y)	2
	Awatovi,	P IV (B/Y)	2
	"	P IV (Y-17)	2
	"	P V (17c)	7
	"	Unassigned	1
	Kawaika-a,	P III-IV	1
	Total		27

All were found in rubbish fill. Since troughed metates are believed to have gone out of use long before the 17th century, the fragments found in Pueblo IV and V rubbish must be regarded as an indication of the continual re-use of materials turned up during rebuilding and the shifting of refuse. The same process would explain the occasional Pueblo III sherds in the latest debris at Awatovi.

MINIATURE TROUGHED METATES

Figure 18, *p*.

These two small slabs resemble nothing so much as toy metates.[3] Both are irregular slabs of fine-grained crumbly yellow sandstone, with a broad trough-like depression worn in them by reciprocal grinding. The small size makes it unlikely that they would be used for serious grinding. The "troughs" are only 10 to 12 centimeters wide. The slabs are 27 and 34 centimeters across. Provenience: Awatovi Pueblo III (B/W) and Pueblo V (17c).

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[3] Toy metates have been reported for the Hopi (Dennis, 1940, p. 51) and Cochiti (Goldfrank, 1927, p. 81).

FLAT METATES

FIGURE 16, *d–h*.

Description. More or less rectangular slabs with one face worn flat or slightly concave from grinding. Entire upper surface is occupied by grinding surface.

Shape and Workmanship. Slabs are shaped by pecking on bottom and edges. Shape subrectangular to oval, usually with some minor irregularities. In the more carefully shaped metates edges and ends are rounded and sloped inward toward the bottom. The under side is irregular but approximately flat. In about 5 per cent of flat metates the ends slope in sharply toward the bottom, resulting in a triangular profile when viewed from the side.

Grinding Surface. Approximately flat from side to side, slightly concave lengthways. Metates are worn thinnest about the midpoint or two-thirds of the way from one end. This concavity results naturally from the manner of grinding, because during the stroke greater pressure would be brought to bear near the middle of the stroke than at the beginning or end. Metates used only slightly are of uniform thickness, and those greatly worn are thinner at one end. But the maximum slope due to this wear is far less than the angle at which metates in modern Pueblos are placed for grinding. Therefore, when in use, they were probably installed in a grinding bin or propped on small stones.

Grinding surface smooth or rough, depending on the amount of use since it was last pecked to roughen it. Some of the metates show the marks of this pecking, and were not subsequently worn down (*see* fig. 16, *e*). How long such a rough surface will last, when the metate is in constant use, is uncertain.[4] But there is no doubt that the reduction of a metate from a thick slab to a thin one was partly due to rather frequent roughening of the surface, and not only to the wear caused by the friction of the mano.

Wear. Generally the thickest metates show little wear and have the flattest grinding surface. Many metates found in rubbish which had been thrown into abandoned rooms are whole, relatively thick, and appear quite suitable for further use. The Hopi women who visited the excavations were eager to have these metates, so there is little doubt of their usability. Others appear to have been discarded only when worn extremely thin, or after they broke because of their thinness. One metate was worn to a thinness of 1.0 centimeters along a line midway between the ends, although the ends were 6.4 centimeters thick.

Double-faced metates. Only a single metate (Awatovi, Pueblo V, 17c) had been used on both faces, a practice reported as occasional at many sites. In other respects it was similar to the other flat metates. Both faces were worn about equally, slightly concave lengthways, and had been roughened by pecking. Original length unknown due to fragmentary condition, width 30 centimeters, thickness 9.4 centimeters.

Size.	Mean	Maximum	Minimum
Length	39.5 cm.	50 cm.	26 cm.
Width	27.2 cm.	39 cm.	20 cm.
Thickness	8.8 cm.	19 cm.	3 cm.

Flat metates are smaller than the troughed forms, without any sacrifice in the area of the grinding surface. Hence, the change to a flat metate was an advantage, because a smaller slab could be used. There is an apparent reduction in thickness, too, because troughed metates preserve their original thickness at the sides and/or ends, but flat metates gradually wear thin over the whole surface. Comparison of flat metates from successive periods at Awatovi shows no size change except for greater thickness during Pueblo III (B/W), but the sample, four specimens, is too small for much significance to be attached to this.

Katharine Bartlett, on the basis of an examination of 50 metates in modern Hopi villages, calculated their mean length as 36 centimeters, mean width 33 centimeters.[5] Thickness could not be determined since they were plastered into grinding bins. There has, then, been a reduction in length and an increase in width since the 17th century, with a slight increase in total grinding area. This would imply the use of a longer mano, and a shorter stroke.

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[4] Katharine Bartlett, of the Museum of Northern Arizona, was told by a Hopi informant, "If a woman ground corn every day, as they used to, the metate had to be roughened up every 5 days." (Personal communication)

[5] Bartlett, personal communication.

Material. See table 5.

TABLE 5: Material and Provenience of Flat Metates

	SANDSTONE						
	Fine	Medium	Coarse	Basalt	Misc.	Unrecorded	Total
Pink Arrow P III-IV	1		2			4	7
Awatovi P III (B/W)	3			1			4
" P III (W-O)				1			1
" P III (B/O)	2	1			1*		4
" P IV (O-Y)	5	4	2	1			12
" P IV (B/Y)	12	11	6		1†	5	35
" P IV (Y-17)	29	12	24	1		4	70
" P V (17c)	110	124	75	4	2‡	13	328
Unassigned	15	9	28		1§	18	71
Kawaika-a, P III-IV	4		1				5
Total	181	161	138	8	5	44	537

* Tuff.
† Quartzite.
‡ One tuff, one limestone.
§ Tuff.

The finer sandstone is mainly from the Mesa Verde Formation, which immediately underlies the site and forms the mesa rim. It is gray to yellow, and frequently rather poorly cemented. Although this matter was not given enough attention in the field, I have the impression that the fine-grained sandstone selected for metates was usually more firmly cemented than that used as building stone, and hence may have come from some preferred stratum of the formation.

The coarser sandstone used for metates is mostly dark brown to red, and is distinctive and easily recognized. Its source is not known.[6] The texture ranges from only slightly coarser than the lighter material from the Mesa Verde Formation, to what might be termed a conglomerate because of the inclusion of rounded particles as large as 0.5 centimeters in diameter. Dr. John T. Hack, Physiographer of the Awatovi Staff, suggests that the limonite cement which holds the particles together in much of this coarse material may wear away faster than the quartzite sand and tiny pebbles, so that a continuously rough surface would result. However, this "automatic" roughening of the surface, due to the dislodging of small particles and the resulting pits, must sometimes have been insufficient, because some of the metates of coarsest texture are roughened by pecking in the same way that the finer grained ones are. Even the coarsest sandstone available in the Jeddito Valley does not give as rough a grinding surface as the vesicular basalt used in many sites farther south. A few metates of this superior material were brought in, probably from the region of the Hopi Buttes or beyond them along the Little Colorado.

Unfortunately, no satisfactory standards were set up in the field for determining texture, and the descriptions in the field cataloguing are mainly subjective. The result is that the finer grades of the red-brown sandstone and the coarser grades of the yellow and gray sandstone were grouped together as "medium-grained," without any record of color. A dual distinction might have been more satisfactory, but the metates cannot now be so grouped. However, there is no doubt that the finer textures were used for a majority of flat metates at all times.

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[6] This is probably the "hard, dark, iron stained sandstone" described by Stephen in the 1880's. (Parsons, 1936b, p. 1306.) He says it "is found in the mesa foothills and volcanic buttes. It is used to make the mealing and rubbing stones."

Modern Pueblo usage is generally a series of three or more metates, graded from coarse to fine, by which progressively finer meal can be ground. Since most of the metates at Awatovi were found singly, convincing evidence is lacking for the existence of the custom in the 17th century or earlier. A few metates found in groups will be discussed below. Some of them may have been "sets" but were not found in position for use.

Provenience and Total. See table 5.

The great majority of the flat metates came from refuse which filled rooms and plazas. But a few were found on the floors of rooms, and sometimes built into place as the walls of small storage bins. Because there are often significant inferences to be drawn from the details of construction and of the contents of abandoned rooms, the following paragraphs will describe rather fully all such instances involving flat metates, or possible bins for them.

Site 104, Room 13 (P II-III). Close to north wall of rectangular room was bin made of four slabs standing on edge in floor. Inside bin was imprint of a metate which had been plastered into place in adobe, later removed. Sloped at angle of 22°. Impression 37 centimeters long, upper end 14 centimeters above lower. Lower end to west. From east slab of bin to wall of room was 47 centimeters, the space in which user would have had to kneel. No arrangement to catch meal at lower end, and hardly room for bowl or basket to have been placed. Small compartment between bin and the wall of room, formed by two additional slabs, might have been for corn storage. Whether metate that was once in this bin was flat or troughed cannot be determined.

Site 4, early Pueblo III. Three grinding bins in the open, near a three-room and kiva unit. Metates and part of slabs had been removed. Possibly there was originally a brush shelter over them. Expansion, later in Pueblo III, added seven more rooms to the unit, in one of which a pair of metate bins was built. Metates missing from these bins also.

Pink Arrow (Pueblo III-IV), Room 14. Flat metate resting on floor, with adobe plaster under edges, just south of short wall which forms side of low bin in northeast corner of room. Probably not in position for use, as insufficient space to kneel between it and wall, and horizontal position of metate would be unusual.

Pink Arrow, Room 19. Flat metate on floor near fire-pit. No other details recorded.

Pink Arrow, Room 23. Flat metate lying on floor. No other details recorded.

Awatovi, Room 296 (Pueblo III, B/O). Flat metate set on edge near center of room, purpose unknown. It is undamaged, about 9 centimeters thick, no reason apparent why it was no longer used for grinding.

Awatovi, Room 243 (Pueblo IV, O-Y or earlier). Flat metate and fragment of another used as building stone to plug T-shaped door, as previously mentioned in connection with troughed metate used here. Flat metate is 9.5 centimeters thick, grinding surface pecked to roughen it, as though for further use.

Awatovi, Room 228 (P IV, O-Y or earlier). Fragment of flat metate used as building stone in masonry of west wall.

Awatovi, Test 26, Room 1 (Pueblo IV, B/Y). Flat metate lay on floor of this very small room, separated from main room by wall 17 centimeters high. No apparent means of propping up metate for use within this small room.

Awatovi, Rooms 626 and 627 (Pueblo IV, Y-17). Common wall contained complete flat metate in masonry, grinding surface worn smooth, thickness 10 centimeters. Metate appears suitable for further use.

Awatovi, Test 33, Room 7 *(Pueblo V).* Flat metate standing on end against east wall of room, perpendicular to wall, plastered into wall and floor.

Awatovi, Room 601 (Pueblo V). Two metates used to form small bin or storage chamber against south wall. Stood on end, grinding surfaces inward. This was, perhaps, a space to store wood for the fireplace nearby against same wall, formed of two ordinary slabs.

Awatovi, Room 718 (Pueblo V). A small Indian room built adjoining the Friary on west. In fill just above floor were four metates of coarse sandstone and vesicular basalt. About 15 manos also in fill. In southwest corner of room bin formed by metate set on end against wall. Against south wall another bin formed by irregular slab plastered into floor, with mano set in plaster of floor across front of bin. This bin, and possibly the other, might have served to hold metates for grinding, but user would have been facing wall. If so used, metates would have to be put in and braced at suitable angle each time.

Awatovi, Test 5 (Pueblo V). Figure 7, *b*, Indian house built close to Church, containing largest assortment of metates of any room at Awatovi. Along south wall were three bins formed by setting four slabs on end perpendicular to wall. Easternmost had served as fireplace; front of it partly closed with two manos set into floor on end. Central bin contained half of plain yellow bowl which might have served to catch meal under end of metate. Westernmost bin contained six metates, two leaning against west and south walls of bin, four piled with grinding surfaces down. All but one considerably worn. Textures: two standing on end, medium-grained and coarse-grained; four piled up, two fine-grained, two medium. This could provide the fine to coarse sequence reported from modern pueblos. But bins have no provision for permanent installation of metates, and if used would require user to face wall. In south wall was niche 20 centimeters above floor (niche 20 centimeters high, 17 centimeters wide, 23 centimeters deep), containing two manos and much-worn three-quarter-grooved hammer. Similar niches appear in Mindeleff's illustrations of Pueblo houses,[7] serving to keep odds and ends, including grinding equipment and stones for pecking grinding surfaces of metates and manos. This is additional evidence that room may have been used for grinding, in spite of lack of metates in place for use.

Awatovi. Several other Pueblo V rooms had bins like those in Test 5 but no metates were found in the rooms (Rooms 448, 456, 499). Room 505 had such bins, one of them containing mano; surrounding fill contained charred corn, unshelled.

Awatovi, Room 503 (Pueblo V). Low shelf or bench along west wall with remnants of vertical slabs which had formed a row of bins. One whole and one fragmentary flat metate on floor. Fill contained charred corn, suggesting possible grinding room.

Awatovi, Test 28, Room 1 (Pueblo V). Bin in southeast corner, with metate lying in it. No traces of arrangements for using it in bin.

Awatovi, Room 419 (Pueblo V). In fill near floor (87 centimeter level) were seven metates and a mano which matched material and contour of grinding surface of one of the metates. In 1937 Mrs. George Harris of Mishongnovi (Second Mesa) visited the Expedition Camp to secure a metate. After careful examination of the available ones, she selected the matching mano and metate from this room. They are now in use in her home.

Awatovi, Room 501 (Pueblo V). Metate lying on floor in northwest corner, grinding surface down.

Awatovi, Test 6 (Pueblo V). Metate on floor in center of room, with five whole and five fragmentary manos. Second story of this building, which had collapsed into lower room, contained corn, apparently in storage.

Awatovi, Test 46, Room 1 (Pueblo V). In southeast corner two storage bins formed by stone slab and wooden board set on edge. Fill contained three metates, several manos, and charred corn.

Awatovi, Room 752 (Pueblo V). One whole and one fragmentary metate in fill with large quantity of corn cobs.

Awatovi, Room 748 (Pueblo V). Metate fragment in fill with corn cobs.

Church 2, Burial 79 (Pueblo V). Metate found in pit in which burial had been made. Possibly intentionally included with corpse, though not lying on it. Metates are reported in burials at Pueblo IV sites of Homolovi, Sikyatki, Chevlon, Chaves Pass and Fourmile.[8]

Discarded Metates and Secondary Uses. In the preceding paragraphs there have been described several instances of metates being used as building stone, and thus incorporated in walls, or used as slabs for the construction of such room furnishings as bins and cupboards. At Awatovi and other Jeddito sites there were no metates used as door sills, a relatively common thing at some sites in the Southwest. But it is rather curious that whole, undamaged and sometimes little worn metates should have been used at all as building stone. No reason appears for discarding them while they were still serviceable, in view of their obvious importance in housekeeping, the care exercised in making them, and the abundance of building stone from both the abandoned parts of town and the great sandstone exposures along the mesa rim. Besides the metates used as building stones, there are many that were thrown into rubbish heaps, undamaged. Of all the metates and metate fragments in Pueblo IV and V *rubbish* at Awatovi about a third are whole metates in good condition for further use. The numbers are as follows:

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[7] Mindeleff, 1891, fig. 101.

[8] Fewkes, 1904, p. 160.

	Fragments	Whole	Total
Awatovi P IV (O-Y)	0	9	9
" P IV (B/Y)	18	15	33
" P IV (Y-17)	33	34	67
" P V (17c)	209	85	294
Awatovi P IV and V Total	260	143	403

There are too few metates from Pueblo III at Awatovi for comparison.

Metates and metate fragments were occasionally used for grinding pigments, and perhaps also pottery clay. Small oval areas, worn slightly concave, resemble the worn portions of grinding slabs and indicate that metates, like any other handy piece of stone, might answer a momentary need for a flat, abrasive surface. It seems unnecessary to list or describe in detail such casual re-use of metates. At Awatovi metate fragments with secondary worn surfaces came from the following Pueblo IV and V periods in the quantity indicated: B/Y (5), Y-17 (3), and 17c (6). A fragment from Kawaika-a is stained red from use in grinding pigment. Similar uses can be cited from archæological and ethnographic reports. For example, at Betatakin a metate had been "last used for pulverizing yellow ochre; a rubbed area on its underside is smeared with red paint."[9] At Tseh So metates were used for preparing pigments and gypsum.[10] Metates are used today, and probably were used in the past, for grinding clay and tempering material for pottery.[11]

HISTORY OF METATES IN THE SOUTHWEST

The development of the metate was outlined in 1933 by Bartlett[12] and subsequently published data attest to the correctness of her account. Consequently, only a brief outline of the subject will be given here, with reference to some of the recent data. Shallow, basin-shaped grinding slabs were in use at a very early date, not only in the Southwest but in most of the region from the Pacific Coast to the Gulf of Mexico. In the Southwest, by Basket Maker III time, there was a well-developed troughed metate in use, generally with one end of the trough open. Such metates occur in the La Plata district[13] and in the somewhat earlier settlements of the Pinelawn Phase of the Mogollon Culture.[14] They were characteristic of a good deal of the Southwest, except for the Gila-Salt River region, where metates had the trough open at both ends. Flat metates began to appear in Pueblo II and early Pueblo III, and gradually replaced troughed metates in the Pueblo regions. Among the earliest reported flat metates are the following:

1) Alkali Ridge, Utah, Site 12 (Pueblo II).[15]

2) Marsh Pass, Arizona, Site RB 551 (early Pueblo II).[16] Here the metates themselves were not found, but the shape of the manos showed that flat metates had been used.

3) Village of the Great Kivas, New Mexico (early Pueblo III).[17] The change from troughed to flat metates took place between the initial occupation of the site and a subsequent enlargement of the village.

4) La Plata district, New Mexico-Colorado: Morris says, "As far as I have been able to determine the flat metate did not make its appearance until after the beginning of Pueblo III and while it rapidly tended to supplant the

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[9] Judd, 1930, p. 53.

[10] Brand, Hawley and Hibben, 1937, p. 90.

[11] Hill, 1937, p. 11; Cushing, 1920, p. 310; Guthe, 1925, p. 21.

[12] Bartlett, 1933.

[13] Morris, 1939, p. 133 and pl. 147.

[14] Rinaldo, 1940, p. 35, fig. 18.

[15] Brew, 1946, fig. 174, *d*.

[16] Beals, Brainerd and Smith, 1945, p. 54.

[17] Roberts, 1932, p. 139.

trough type, the latter continued to be used until the abandonment of the San Juan country."[18]

5) Chaco Canyon, Site Bc 51 (Pueblo II or early Pueblo III.)[19]

Although the replacement of troughed by flat metates proceeded rapidly during the first part of the Pueblo III period, the earlier form occasionally persisted. They were still in use when Pinedale was settled in the 13th century,[20] and at Aztec Ruin (Pueblo III)[21] both forms seem to have been in use, although the troughed metates may come from the earliest years of the village, or even from an occupation previous to the building of the main pueblo. In Pepper's notes on Pueblo Bonito[22] he describes troughed metates as "typical," although flat metates were also in use. An unusual group of multiple troughed metates came from a room at Pueblo Bonito, large slabs with 2, 3 and 4 grinding surfaces side by side. There is a possibility that these were for the grinding of special meal to be used ceremonially, as the room is just south of one of the main kivas, and contained two shell trumpets in addition to the grinding equipment.[23] The only other such multiple metate, also troughed, of which I know was found in Navaho Canyon near the Arizona-Utah line, and is of unknown date.[24]

The origin and development of the "Utah type" of metate is puzzling. We have no assurance that those of central and northern Utah[25] are related to the few such metates from Arizona. Troughed metates with a shelf at the closed end, quite similar to those characteristic of Utah, were found at Kiatuthlanna in Pueblo I pithouses,[26] and at the Bear Ruin[27] which was approximately contemporary with Jeddito Site 264, where two such metates occurred. The shelf appears less developed, but is nevertheless present, on some of the metates at the 4th century Bluff Site, of the Mogollon Culture, located close to the Bear Ruin.[28] This is insufficient evidence for establishing a point or date of origin and tracing the dispersal, although the usual procedure is to assume that such scattered occurrences as these derive from the influence of a center where the trait has greatest frequency, which would, of course, be Utah. The greater age of the Mogollon Culture occurrences, however, suggests them as a source.

I believe that the shift from a troughed metate to the flat form was mainly for practical reasons. As long as the metate was movable, and was propped on the floor each time it was used, the troughed shapes were more convenient. The bordering ridges kept meal from spilling off the grinding surface and also made the metate stronger during the later stages of wear, and less easily broken in handling. The flat metate was generally used in a bin, plastered permanently in position, with slab or adobe sides taking over the function of the bordering ridges. At the same time, the architecture of the Pueblo peoples was changing profoundly, and separate rooms were being built for domestic (family) and for religious (group) activities. To evaluate the relation of this architectural change to the change in milling technics, the evidence will be presented in considerable detail in the next few paragraphs.

USE OF METATES IN THE PUEBLO CULTURE

There is little risk in assuming, on analogy with the modern Indian culture of the Southwest, that metates were used in prehistoric times for grinding corn, and probably other foods as well. Since the introduction of agriculture, corn has been a major source of food in Pueblo[29] culture, supplemented with wild seeds in addition to beans and squash. Therefore corn may not have been the only thing ground on metates. As Kroeber pointed out years ago,[30] the metate and metate-like implements spread far beyond the limits of corn cultivation, into the Great Basin and to the Pacific Coast. And conversely, metates are absent in large parts of North America where corn was grown. So the association between metates and corn is far from general. It has frequently been assumed that mortars and grinding slabs served purposes somewhat different from metates, just as the implements differ from each other. Rinaldo, for example, has inferred a reliance on "roots, nuts, and wild seeds" and a secondary concern with agriculture at the SU site, because grinding tools of "the more undeveloped 'primitive' type are the most frequent in this period."[31] I seriously doubt if we can infer much about the various foods eaten on the basis of degree of specialization in grinding tools, although the picture Rinaldo draws, of reliance on a variety of food resources, both gathered and cultivated, is probably correct for this early date. Haury has suggested that the shelf on some of the troughed metates at the Bear Ruin might have been used for crushing seeds,[32] although there were grinding slabs at the site that may also have been used for seeds. Of the three metates of this form found in the Jeddito area, only one has evidence of even a slight amount of grinding on the shelf.

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[18] Morris, 1939, p. 133.

[19] Woodbury, 1939, p. 58.

[20] Haury, 1931b, p. 53.

[21] Morris, 1928b, p. 369.

[22] Pepper, 1920, pp. 90, 257, 270.

[23] Pepper, p. 85 and fig. 29.

[24] West, 1925, p. 14 and fig. 12.

[25] Smith, 1936; Steward, 1933a and 1941; Judd, 1926.

[26] Roberts, 1931, p. 154.

[27] Haury, 1940, p. 98.

[28] Haury and Sayles, 1947, p. 66, fig. 26, *b*.

Aside from the doubtful possibilities of determining what kinds of food might have been used, metates demonstrate remarkably well the persistence of certain motor habits over long periods. In fact, the final shape of a metate is largely a result of the particular motions which its user has repeated. Slight variations in the evenness of the bottom or the curve of the ends are far less significant than the contours and position of the grinding surface. The basin-shaped grinding slab represents a very different set of motions from those used on a metate. Accounts have been published of the mechanical details of Pueblo grinding, particularly Bartlett's excellent paper.[33] An almost identical series of motions exists among the Gila River Yuman tribes, as reported by Spier. There, as in the earlier days of the Pueblo peoples, the metate was not permanently fixed, but could be moved about. The description of its use might well apply to Basket Maker III metates:

> When the metate was used, the woman knelt behind it. A pestle or other convenient stone was placed under the near end to raise it. A cloth was spread under the far end to catch the ground meal; the unground grain was in a basket by the side. The mano was grasped with the hands so that the fingers were over the forward edge, the thumbs over the rear. It was moved to and fro, perfectly flat, for most of its stroke, but rocked, i.e., the near edge was raised, at the end of the stroke toward the body to catch more grain under it. It was not rocked transversely to the metate. This motion accounts for the flat, longitudinally concave surface of the metate. When the surface became too smooth to catch the grain, it was roughened by pecking with a fragment of hard stone. They usually turned the slab face down resting on the mano when it was not in use.[34]

Compare with this the way in which the Havasupai use a grinding slab. Not only the forms of the implements used differ from the metate and mano, but the process of use is radically different.

> The grinding slab, on which nearly all wild and cultivated seeds are ground, is roughly rectangular. . . . A shallow oval, but nearly rectangular, depression is pecked in one face with a hammerstone. The mano is roughly a prolate spheroid 17 to 22 cm. long, with short diameters of 7.5 and 10 cm. The woman sits in front of the slab which rests flat on the ground, with its face slightly tilted toward her. The corn, beans, etc. are first pounded with the end of the mano, and then crushed with a pounding, rocking motion of the stone. The meal is brushed off forward with the side

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[29] Pueblo is used "to designate that assemblage of traits which is generally accepted as the Basket Maker-Pueblo basic culture," as suggested by Brew (1946, p. x). "Puebloan" can be used interchangeably for Pueblo, in this sense. The latter term is Dr. Kirk Bryan's.

[30] Kroeber, 1925, p. 412.

[31] Rinaldo, 1943, p. 177.

[32] Haury, 1940, p. 112.

[33] Bartlett, 1933.

[34] Spier, 1933, p. 127, pl. III, *c*. Some thousand years ago, at Whitewater Village, a woman who had finished grinding did the same thing. Excavation revealed the metate turned over, lying on the mano. (Roberts, 1939, p. 158.)

> of the hand into a tray basket. The chaff is separated. . . . The clean meal is then replaced on the slab to be pulverized by grinding with an additional slight rocking motion, forward and back, and to a lesser extent sideways. There can be no doubt that the shape of the metate depression and mano among Indians in general is in part the result of the miller's movement. When not in use, the grinding slab is turned upside down with one edge resting on the mano to keep it clear of the ground.[35]

Notice that the slab is tilted *toward* the grinder and that both pounding and grinding are used. A very similar set of motions must have produced the basin-shaped slabs of the early Mogollon people and of their Cochise Culture forebears. In terms of mechanics, it may be noted in passing, that there are at least two other distinct New World milling technics: a Central American method, in which a cylindrical handstone was rolled as well as rubbed on the metate (used for leached corn, still wet)[36] and an Andean method of the Inca and Aymara, using a large heavy rocker with curved under surface.[37]

The mechanics of grinding on a metate can best be understood from watching the process, or in lieu of that, studying published illustrations. Among the best for this purpose are the following:

Pima (Russell, 1908, fig. 28)
Navaho (Kluckhohn and Leighton, 1946, opposite p. 92)
Hopi, mid 19th century (Ives, 1861, pl. XI)
Hopi, late 19th century (Winship, 1896, pl. LXIV)
Hopi, early 20th century (Curtis, 1922, opposite p. 44)

In the Pueblo area it is probable that women did the grinding in Basket Maker times as they do today. For this reason it is interesting that in some of the oldest pithouses which have been found with their furnishings in place, there is often a clearly delimited portion of the room where women's housekeeping activities were centered. This has been noted at the following sites:

1) Jeddito Site 264: the troughed metate described above was found in a section of the room bounded on the south by a walled off masonry recess and on the north by a low partition. (*See* fig. 7, *a*.) Such partitions occurred in several other pithouses at BM III sites in the Jeddito, but the small southern part of the rooms lacked furnishings.

2) Alkali Ridge, Site 13, Pithouse B had metates, manos, hammerstones, a maul and several pots in the south end, which was separated from the main room by a partition at least a meter high.[38] "Most of the metates found at Alkali Ridge were in the southern ends of pithouses and in the large above-ground living rooms. . . ."[39]

3) La Plata District:[40] In several pithouses ridges of mud extend radially from fireplace to wall of room. "That these ridges were partition symbols would seem to be confirmed by the fact that slightly later the two [ridges] were often replaced by true screens or partitions of slabs, or adobe, often 60–90 cm. in height, which cut off a definite compartment across the south side of the chamber. Usually metates were installed in this compartment, suggesting that it was a specific domain of the woman of the household."

4) Shabikeschee Village: Pithouse D. "In the portion of the compartment at the eastern side of the room a large metate was in place. This suggested that the inclosure may have been used as the family milling place."[41] Similar compartments at the side of the room, with metates in them, were found in the "proto-kiva" and in House X.

5) Whitewater Village: Two metates were leaned against the wall in an enclosure at the southeast corner of the pithouse. "This would suggest that the enclosure may have served as a mealing bin for the house."[42]

Other early pithouses do not have special sections reserved for milling. In them, the metates were set up in any convenient part of the room, and kept leaned against the wall when not in use or when the space was needed for other activities. Even without the metates, the floor space must have been scarcely more than adequate for sleeping. The rooms would have been extremely cramped for any ceremonies involving an extended family or other social group larger than the biological family. Consequently, it is not surprising that even when there was a portion of the room reserved for grinding, the metates were not permanently installed. They could be stood in a corner, out of the way, when necessary. In use they usually rested on one or more small stones, as is described, for example, at La Plata sites[43] and Whitewater Village.[44] Of the latter Roberts writes: "The metate stone was raised above the floor by a base consisting of three stones. This additional height would make it possible to set a shallow basket or tray under the open end of the trough and catch the meal as it dropped from the grinding stone." In the Pueblo area it never seems to have been customary to achieve the desired slope of the grinding surface by using a wedge-shaped metate. Such metates were used in the Pinelawn Phase of the Mogollon Culture and were never propped up on small stones.[45]

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[35] Spier, 1928, p. 114.
[36] Redfield and Villa R., 1934, pl. 5, *a*.
[37] Rowe, 1946, p. 221.
[38] Brew, 1946, p. 163, figs. 30 and 95.
[39] Brew, 1946, p. 156.
[40] Morris, 1939, p. 25, figs. 7 and 14.
[41] Roberts, 1929b, pp. 23, 63, 69.
[42] Roberts, 1939, p. 25. Also p. 90.

In the La Plata district one pithouse had an adobe device in which a metate could have been permanently installed.[46] The sloping adobe trough, in which the metate would have rested, had a flat slab at the lower end, bordered with mud ridges, like the provision made for catching the meal in later bins. There is little doubt that a metate once occupied the support. It is, then, the earliest metate bin so far reported. Just a little later than this there seems to have been some experimenting in metate placement at Whitewater Village. In several of the pithouses there are stone slabs built into the floor in the main part of the room (Structures 2, 3, 5a, 12 and 13b).[47] Roberts suggests that this may have been a support for a metate. Such a slab would prevent the wear that an adobe floor would suffer from the repeated shifting of a heavy metate. In one of the pithouses (Structure 12) there was an oval depression in the floor alongside the slab, an arrangement suggestive of the permanent installations that became common later, which provided an adobe or stone basin to catch the meal. If Roberts is correct, and metates were used on these slabs, the invention proved abortive. The metates still had to be removed on occasions when the pithouse was crowded by large gatherings. The development of a satisfactory metate bin was delayed until specifically domestic rooms were available in the surface structures that succeeded pithouses.

By the close of Basket Maker III in the Pueblo area there was a tendency to transfer part of the family's daily activities to rooms being built on the surface and to open air working spaces. In the La Plata district a crescent of small surface rooms stood behind the pithouse, and on their roofs and the roofs of the pithouses are found dishes, metates and manos, and the remains of fireplaces "indicating that the flat house tops were actually living rather than storage places."[48] At Whitewater Village (Pueblo I-II) simple brush shelters were erected near the houses, serving as "general outdoor foci of domestic activity."[49] With metates propped up on stones ready to use, and with fireplaces, much of the family routine could take place there in good weather, and the space would never be needed for other uses. A similar outdoor work area was found in a village of the Rosa Phase, in New Mexico, contemporary with Pueblo I-II. It had a firepit, storage cist, three metates, ten manos, and several hammerstones, pot polishers and cores.[50]

The change from a domestic to a ceremonial use of the pithouse has been traced with great care by Brew.[51] The freeing of pithouses for chiefly ceremonial activities, thereby making them "kivas," was made possible by the development of surface rooms that were satisfactory for full time houses, instead of storerooms and fair weather working places. Conversely, the transfer of more domestic activities to these surface rooms stimulated their elaboration from simple little storerooms to the complex series of rooms still being built by the Pueblo

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[43] Morris, 1939, pp. 60, 71.

[44] Roberts, 1939, p. 139.

[45] Rinaldo, 1943, p. 176. The occurrence of a few wedge-shaped metates at Tuzigoot (Caywood and Spicer, 1935, p. 76) may be a coincidence, rather than survival of a practice unrecorded for the intervening centuries.

[46] Morris, 1939, p. 60, pls. 16, 17.

[47] Roberts, 1939, pp. 38, 49, 64, 108, 122.

[48] Morris, 1939, pp. 26–27.

[49] Roberts, 1939, p. 177.

[50] Hall, 1944, p. 16.

[51] Brew, 1946, 203–26.

Indians. One change that was made possible, and the one that concerns us here, was the permanent installation of metates, plastered in position at the most convenient angle and often with carefully made basins under the lower end to receive the meal. The shift of domestic life to surface rooms proceeded during Pueblo I and II, but as anyone familiar with the modern Pueblo is aware, it is not yet complete. Kivas are used for sleeping by the men whenever convenient, many of their handicrafts are pursued there, and only at brief recurrent intervals is it a wholly ceremonial chamber. Metates have sometimes been found in well-developed kivas. At Wingate, New Mexico, a metate occurred in a late Pueblo II "kiva" which was elaborated for ritual use beyond what might be expected if it had served mainly as a house.[52] Whether the metate was present fortuitously we cannot know. At Marsh Pass, Site RB 1008, a flat metate lay on the bench of a Pueblo II subsurface room, presumably a kiva. There is no evidence that it had been used in the kiva, nor is there indication in the nearby surface rooms of any provision for grinding.[53] Metates have been found occasionally in fully developed kivas, as at Aztec[54] and Nanishagi.[55] There is a possibility in the latter instance that the metate was actually installed in the kiva for some special use. Such examples, even if multiplied, serve only to emphasize that there are exceptions to every generalization we make about the customs and practices of the Pueblo people. Pithouses were not suddenly or completely transformed into kivas. In such minor affairs as grinding practices there were delays and survivals, and progress was not at a uniform rate everywhere.

The metates in surface houses were not always put in bins at first, but the advantages of permanent installation were quickly realized. Bins have been found at several Pueblo II sites:

1) Alkali Ridge, Site 12: Two bins with flat metates.[56]

2) Marsh Pass, Site RB 551: Two bins, probably with flat metates.[57]

3) Metate House (NA 1764A) near Flagstaff: Troughed metate.[58]

4) Blue Post Office: Troughed metate with adobe base and rim.[59] Date uncertain.

5) Jeddito Site 104 (P II-III): Single bin, metate missing.[60]

In most surface rooms in which grinding bins have been found, flat metates were used. The appearance of the bin is simultaneous with the first flat metates in the La Plata district[61] and at the Village of the Great Kivas.[62] The association of bins and flat metates is certainly more than coincidence. The invention of the bin, with its slab or adobe sides, made the ridges along the sides of the metate unnecessary. A much smaller slab would provide as great a grinding surface, and when plastered into place would not need weight or size to make it immovable. With space available for permanent grinding bins, the advantages of bins led to their general use in the Pueblo area. Whenever the bin came into use the trough metate was soon superseded by the flat metate. Indirectly, then, the flat metate seems to owe its development to the shift of domestic activities to purely domiciliary rooms, away from the less spacious subsurface rooms where the entire floor was periodically needed for group activities.

Grinding bins are by no means uniform in details of construction. Variations occur in (1) number of bins, (2) position in room, (3) angle of slope of the metate, (4) arrangements for catching meal and (5) texture of metates. Most published descriptions omit some or all of these details. A survey of the incomplete information available shows that the most uniform aspect of grinding bins is their position in the room. Nearly always they are set out from the wall sufficiently for the grinder to kneel at the bin with her back to the wall. That her toes were often braced against the wall could, I believe, be demonstrated by careful examination of the walls in rooms where bins have been found. Even before the invention of grinding bins, metates were sometimes propped up in this same position.[63]

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[52] Gladwin, 1945, p. 70.

[53] Beals, Brainerd and Smith, 1945, p. 70 and G. W. Brainerd, personal communication.

[54] Morris, 1924, p. 248.

[55] Reiter, Mulloy and Blumenthal, 1940, p. 9 and pl. 3*a*.

[56] Brew, 1946, p. 147.

[57] Beals, Brainerd and Smith, 1945, p. 46.

[58] Bartlett, 1933, p. 17, figs. 3, 4. Colton, 1946b, p. 133.

[59] Hough, 1907, p. 56.

[60] *See* p. 56 for details.

[61] Morris, 1939.

[62] Roberts, 1932.

There were other advantages, besides the economy in material and convenience for working, that probably resulted from the use of grinding bins in series. Perhaps an important consideration was the possibility of group work, instead of the more solitary work in a pithouse. Until the past generation or two, a Pueblo woman spent an important part of her time each day grinding meal. In 1899 Dorsey wrote, "Every Hopi woman spends on an average three hours out of every twenty-four on her knees . . . over a metate."[64] This sounds like a reasonable figure in view of what Katharine Bartlett has been told by Hopi informants, that a family used about three quarts of corn meal a day.[65] These hours would be far more agreeable when several women worked together, enjoying each other's company, as could be done when several metates were set up in the same room. The practice of working in a group may be of as great antiquity as the use of series of grinding bins. Besides a number of recent descriptions,[66] it was observed by Coronado's men in 1540 and reported in the narrative of Castañeda.[67] Besides the incentive offered by such a situation, with its potential competition, and the pleasure of gossip, jokes and songs, there is also an excellent opportunity for teaching young girls proper grinding technics. Cushing, writing of Zuñi, refers to the teaching of girls to grind with such skill and grace that they could entice and tease their lovers while working.[68] Hopi girls, besides having toy metates,[69] were taught at an early age how to grind on real metates and expected to be able to perform for visitors.[70] The two miniature troughed metates found at Awatovi are believed to have been toys of this sort.

At Awatovi the question arises of where grinding was done. As already reported, no typical bins were found with metates in place. Possibly the small compartments against the walls of several rooms could have been used, with the metates which we found stacked up in them. But there is no record anywhere else of such compartments being for more than storage. They are unlike the grinding bins now used by the Hopi. It seems quite improbable that grinding bins were not in use at Awatovi. They were seen at Zuñi in 1540. At Jeddito Sites 4A and 104 grinding bins were found, although the metates had been removed. The first description of Hopi grinding bins of which I know is by Lt. Ives, who visited Mishongnovi (Second Mesa) in 1858 on one of the government survey trips. He was accompanied by the artist Egloffstein, whose sketch of a house interior shows a woman grinding at a metate in a series of four bins.[71] At Awatovi two centuries earlier such series of metate bins must have been in use. Since nearly 1000 rooms were dug by the Peabody Museum expedition, it is surprising that we found none. I believe that they were in the upper story rooms, all of which had collapsed. It is also possible that all bins had been torn out, to remove the metates or the stone slabs for use elsewhere. The abandonment of the site was probably less abrupt than Hopi legend suggests, and during a gradual desertion the village would have been stripped of many useful articles such as roof beams, metates and perhaps even well-smoothed stone slabs. The basis for suggesting upper-story rooms as the place of grinding comes from evidence at other sites. At Pecos[72] metates and slabs from the bins were jumbled together where upper floors had collapsed. At Aztec[73] several upper rooms contained sets of grinding bins, some intact and some collapsed, but there were none on ground floors. At Unshagi, "the majority of metates from room excavations came from such a position in the room-fill that the assignment of an original locus to the roof or second story was indubitable."[74] Therefore, it is not unreasonable to suppose that such bins existed at Awatovi, even though the metates and bin slabs were not found in the fill of fallen rooms. It is interesting that Fewkes may have found metate bins at Awatovi, although his only statement on the subject is characteristically vague: "In almost every house that bore evidence of former occupancy, beautifully made mullers and metates were exhumed. These are ordinarily in place in the corner of the chamber, and were much worn, as if by constant use."[75]

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[63] Morris, 1939, figs. 7, 14.

[64] Dorsey, 1899, p. 741.

[65] Bartlett, personal communication.

[66] Cushing, 1920, pp. 383–387; Hough, 1915, pp. 62–63; Herzog, 1936, p. 310 *et seq.*

[67] Winship, 1896, p. 522.

[68] Cushing, 1920, pp. 307–309.

[69] Dennis, 1940, p. 51. Toy metates at Cochiti are mentioned by Goldfrank, 1927, p. 81.

[70] Hough, 1915, p. 63.

[71] Ives, 1861, p. 121 and pl. XI. Ives' description is reprinted, without illustrations, in Donaldson, 1893, p. 30.

[72] Kidder, 1932, p. 71.

[73] Morris, 1928b, pp. 275, 369, 388, 391.

The metate bins of the modern Hopi embody a few minor changes from prehistoric Pueblo custom. Wooden boards are used to construct the bin, whereas sandstone slabs were formerly used almost to the exclusion of wood. Today the Hopi leave a space along the left side of the metate, a narrow depression between metate and partition, as well as the basin at the far end.[76] The number of metates is now generally two, although as many as six have been seen in recent years.[77] The usual number in the 1880's was three, to judge from Mindeleff's careful report of Zuñi and Hopi houses.[78] The reduction in number may well be due to the use of rotary hand mills today. In 1947 I was told by an old woman living at Mishongnovi that she always starts grinding with a rotary mill, then grinds the meal two or three times on metates. She has three metates, one coarse and two fine, and she uses the latter two alternately, "to rest" because "each metate feels differently." She added that metates "last your lifetime" now, because wheat flour is used for most baking, corn only occasionally for old-fashioned dishes. She had inherited the coarse metate from a "grandmother" so its age may be considerable. An innovation in metate bins that I noticed is a "portable bin." The metate was plastered into a very heavy wooden frame, similar to permanent installations except that the frame with the metate in it could be stood in a corner or put in a storeroom out of the way, when not in use. Dennis[79] has reported that at Hotavila, the conservative town of Third Mesa, it is a matter of principle not to use machines or new methods to reduce the labor of corn grinding. So in spite of a few minor changes, metate bins may persist for a long time in essentially the form in which they were first developed in Pueblo II and III times.

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[74] Reiter, 1938, p. 163.

[75] Fewkes, 1898a, p. 626.

[76] Bartlett, 1933, p. 15, fig. 17 and personal observations at Second Mesa in 1947.

[77] Bartlett, personal communication.

[78] Mindeleff, 1891, *passim.*

[79] Dennis, 1940, p. 14.

MANOS

GENERAL REMARKS

DEFINITION

THE tabular piece of stone held in the hands and rubbed back and forth on a metate for grinding. As a metate has been defined previously in this report as used only for reciprocal grinding, the use of the term "mano" should be similarly restricted. Therefore, stones used with a rotary motion are excluded.

NOMENCLATURE

Grinding surface refers to that portion of the mano which would be in effective contact with the metate. Two, and occasionally even three grinding surfaces may occupy the same face of a mano. If one face of mano has not been used for grinding it may be termed the "upper" face.

Edges and *ends* are the longitudinal and transverse portions, respectively, of the perimeter of the mano. These terms are preferred to "sides."

Finger grips are short grooves pecked in the edges of some manos, presumably to aid in holding the manos. Either the fingers or the thumbs may have been placed in them.

Parallel is used to compare not only two flat surfaces but also a flat with a convex surface, or two convex surfaces. In these instances a plane tangent to the curved surface should be imagined.

Wedge-shaped has sometimes been used to refer to the cross-section of a mano the faces of which are not parallel. It is not a sufficient description, however, without the number and position of the grinding surfaces also being specified.

Prismatic and *triangular* are terms not used here, except in their ordinary descriptive sense, although they are common in the literature of archæology. Prismatic can mean any one of a great variety of geometric shapes and hence is a poor name for a mano "type." Triangular is a convenient description for certain cross-sections, but like wedge-shaped, is not enough by itself.

CLASSIFICATION

The large number of manos (over 2,000) and the relatively minor differences between most of them created both a problem and an opportunity in classification. In general, the form of the mano is determined chiefly by the manner in which it was used, and the shape of the grinding surface of the associated metate. Also, the size and shape of manos is limited to what can be rubbed back and forth easily, held comfortably and firmly. The account quoted above (p. 60) of the way a metate is used gives a good idea of the mechanics of grinding. Any such activity becomes highly standardized if constantly repeated. However, a very slight change in these motor habits may produce, if again standardized, a radically differently shaped mano.

For convenience and speed in the field cataloguing a system was developed by which it was hoped we could record all of the minor variations that might prove to be areally or temporally significant, in addition to furnishing details that might be significant in an interpretation of function. The following notations were used:

Number of grinding surfaces (from 1 to 4) indicated by roman numerals.

Relation of opposite faces, when viewed in transverse cross-section:

A: parallel
B: not parallel
C: two grinding surfaces adjoining on the same face

Number of finger grips indicated by arabic numerals (0, 1 or 2)

The shape was recorded (oval, rectangular, rounded-rectangular, etc.), also dimensions and material. As with all stone artifacts, a sketch was made on the back of the field catalogue card.

In practice, the simple notation "II B 1" would indicate that a mano had two grinding surfaces on opposite faces, a wedge-shaped cross-section, and a finger grip in only one edge. Although there are 36 possible combinations of these features, even without regard to shape, material and size, there are actually only 19 that occur as frequently as 2 per cent of the total in any single period at Awatovi or in any single site. Analysis of the individual features and of various combinations of them has shown that some can be regarded as of minor significance, since there is no appreciable change in their frequency in different periods or sites, and no functional inferences can be made. For the largest group of manos, those with a single grinding surface, used on flat metates, these minor details are reported and discussed at length. The results are of some interest, and demonstrate the potentialities of even such simple tools as manos for intensive analysis.

Instead of the "types" identified by code number that were used in the field, the manos are separated in the descriptions that follow into only eight groups:

Convex-surface (for use with troughed metates)
1 grinding surface (for use with flat metates)
2 adjoining grinding surfaces (for use with flat metates)
2 opposite grinding surfaces (for use with flat metates)
3 grinding surfaces (for use with flat metates)
4 grinding surfaces (for use with flat metates)
Unused manos
One-hand manos

The last category, identified by a term I am not entirely satisfied with, includes manos so short that they were presumably held in only one hand. There is some doubt whether or not they were used on metates only, but they have sufficient similarity to each other to be grouped within a single category. "Handstone" has sometimes been used to refer to these short mano-like stones, but it also may apply to the round or oval grinders used for rotary grinding on slabs. "One-hand manos," as defined here, were used for reciprocal grinding, like the other manos. A satisfactory set of terms has not yet been found for all the implements used in grinding, rubbing and pounding, with overlapping functions and similar shapes. "One-hand manos" and the other terms used in this report are defined in connection with the detailed descriptions of the implements concerned, and are not always synonymous with the usage of other authors.

CONVEX SURFACE MANOS
(For Use on Troughed Metates)

Figure 17, *a*.

Definition. Manos which were used with the various forms of troughed metates, resulting in a grinding surface on the mano that is conspicuously convex from end to end.

Shape. Oval to rectangular, ends rounded. When finger grips are present the edges are slightly concave, giving a constricted shape.

Transverse cross-section. (1) fairly symmetrical, oval to rectangular, with varying degrees of curvature of the edges and upper surface, 58 per cent: (2) wedge-shaped as a result of unequal wearing down of the mano, 42 per cent. Upper face of most manos shaped by pecking and slightly convex.

Longitudinal cross-section. Lenticular. Grinding surface is convex from end to end, to fit the trough of the metate, with ends curving up sharply because of being worn by sides of trough. It is probable that each mano fitted only a single metate, since there are slight variations in the widths and depths of the troughs. It would be possible to grind only with a perfect fit. In this respect, the invention of the flat metate was an improvement, because it standardized the shape of the metate's grinding surface and made it possible for most manos to fit almost any metate.

Grinding Surface. The majority have a single grinding surface, approximately flat from side to side, and convex from end to end. The reason for using only one face for grinding is probably that use of the other face would increase the wear very greatly at the ends, shortening the mano so much that its efficiency would be reduced. In this respect also the flat metate was an improvement, because the manos used on flat metates were not shortened by wear, only made thinner.

A few manos have more than one grinding surface. Two convex surfaces, both suitable for use on a troughed metate, occur on a mano from Awatovi (Unassigned). It is shorter and thicker than most convex surface manos.

There are four manos with a flat grinding surface opposite the convex one, suggesting that they were used on a flat metate as well as a troughed. They are from horizons antedating the use of the flat metate, so must have been used on some of the ubiquitous irregular grinding slabs. They may have been ground, however, to improve the appearance of the upper face, or provide an area to be used as a whetstone. Provenience: Site 264 (BM III-early P I), 2. Site 4A (BM III-early P I), 1. Site 4A (P II), 1.

Also unusual are three manos with convex grinding surfaces, each of which has on the opposite face two flat grinding surfaces meeting at an obtuse angle along the center line (fig. 17, *b*). There are a large number of manos used on flat metates with such a pair of adjoining grinding surfaces, and so it is possible that after their use on troughed metates they were subsequently used again in this fashion on flat metates. Provenience: Site 264 (BM III-early P I), 1. Awatovi, P IV (O-Y), 1. Awatovi, P V (17c), 1.

Finger grips. Present on 34 per cent. Usually there are two when the upper surface of mano is parallel to the lower, and only one when mano is wedge-shaped. In the latter instance, if a second finger grip was originally present, it has been worn away along with the rest of the edge.

Size.	Mean	Maximum	Minimum
Length	18.0 cm.	25 cm.	14 cm.
Width	10.2 cm.	12 cm.	8 cm.
Thickness	3.8 cm.	7 cm.	2 cm.

Material.	
Coarse-grained sandstone	20
Medium-grained sandstone	8
Fine-grained sandstone	10
Quartzite	6
Vesicular basalt	1

The discussion of sandstone textures on p. 55 applies here.

All the quartzite manos are from Site 264.

Provenience.		
Site 264,	BM III-early P I	27
Site 4A,	BM III-early P I	4
Site 4A,	P II	1
Site 264,	P II (Room 42)	1
Site 4,	P III	1
Awatovi	P III (B/W)	1
”	P III (B/O)	1
”	P IV (O-Y)	1
”	P IV (B/Y)	3
”	P V (17c)	3
”	Unassigned	2
Total		45

Five *in situ*, as follows:

Site 264, Room 19, Basket Maker III-early Pueblo I, surface room, mano with troughed metate on floor.

Site 4A, Room 18, a Basket Maker III pithouse, with two manos on floor (one shown in fig. 17, *a*), both of coarse sandstone, with two troughed metates also on floor.

Site 4A, Room 21, masonry room in Pueblo II unit, mano on floor, of unusual white sandstone, very porous and coarse. There was also a troughed metate on the floor.

Awatovi, Pueblo III (B/W), Room 330, mano used as building stone in wall.

The presence of a few convex surface manos in late horizons, particularly Pueblo IV and V, when troughed metates were no longer in use, is doubtless the result of mixture of earlier material with the refuse of these periods.

MANOS FOR USE WITH FLAT METATES

MANOS WITH SINGLE GRINDING SURFACE

Figure 17, *c*, *d*.

Note. This form of mano is discussed at greater length than the others for two reasons: first, this is the only type of which there are a sufficient number from the earlier horizons to justify detailed comparisons of material, size and other features. Second, the processes which modified the mano as a direct result of its use are similar for all manos, and need not be repeated in subsequent descriptions. The other shapes are the result of the same motions that produced the variations in single grinding surface manos, with only slight modifications. Most of the discussion of the mechanical aspects of grinding made here will apply to the other manos as well.

Definition. A mano with a single grinding surface, used on a flat metate. Grinding surface may or may not be parallel to upper face, and finger grips may or may not be present.

Shape. Oval to rounded-rectangular.

Transverse Cross-section. (1) Oval to rectangular, when the grinding surface is parallel to the upper surface. Varies with degree to which upper surface is rounded, and amount of pecking of edges. (2) Wedge-shaped, when upper and lower faces not parallel. With both cross-sections upper surface varies from complete regularity produced by careful pecking, to great irregularity with no attempt at smoothing.

Longitudinal Cross-section. Rounded rectangular. Ends usually rounded. As in all manos used on flat metates there is very slight longitudinal convexity of grinding surface, so slight in comparison with manos used on troughed metates that it is justifiable to speak of grinding surface as flat.

Grinding Surface. Flat from end to end, and flat or slightly convex from side to side. Whether the grinding surface is parallel to the upper surface or not depends on the manner in which the mano was held when used for grinding, rather than on any preliminary difference in the shape of the mano. In descriptions of grinding methods of the modern Pueblos there is mention of the raising of the nearer edge of mano on the return stroke in order to drag the partly ground meal back up the sloping metate. Such a *return* stroke would probably never produce the oblique wear noted on some manos,[1] although it might put a very narrow bevel on the edge. The oblique wear is much more likely to be the result of the method that Bartlett describes[2] in which the *far* edge of the mano is slightly raised during the down stroke, to catch the corn under the mano. The greatest pressure is thus put on the near edge of the mano, directly under the heel of the grinder's hands. As illustrated in Bartlett's study, this can result in two shapes of mano: the first with a single grinding surface, not parallel to the upper surface, which gradually becomes wider as it wears until it is the full width of the mano and the near edge is reduced to a thin, sharp border (fig. 7). The second shape has two grinding surfaces, meeting at an obtuse angle along the center of the lower face of the mano, the result of turning it horizontally end for end and so distributing the wear along both edges instead of one. Only manos of the first shape are being considered in this section. The second will be described below, as Manos with Two Adjoining Grinding Surfaces.

If the mano is continued in use until the stage shown in figure 7, *c* is reached it gradually becomes narrower and finally is too uncomfortable to hold on to and is discarded. By no means all the whole manos found in rubbish were worn down to their possible minimum, and they must have been discarded for other reasons while still in useful condition.

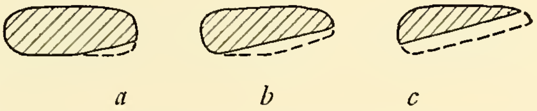

Fig. 7. Successive Stages in the Wear of a Mano with Single Grinding Surface (after Bartlett, 1933).

Finger Grips. Present on 31 per cent. More often present on manos worn down evenly (both faces parallel) and usually present on both edges if at all. Manos with wedge-shaped cross-section less frequently have finger grips, and if so usually have but one, the other having been worn away along with the rest of the edge.

Size.	Mean	Maximum	Minimum
Length	25.0 cm.	36 cm.	17 cm.
Width	11.2 cm.	16 cm.	7 cm.
Thickness	4.6 cm.	12 cm.	1 cm.

Relation of Size to Shape. Size differences appear to be slight between the manos of different cross-sections and between those with and without finger grips. There are sufficient specimens for such comparisons only from Awatovi, P V. Data for this period, based on all whole manos with single grinding surface, are as follows:

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[1] Guernsey, 1931, p. 108, implies that this is the reason for bevelling, and Morris, 1939, pp. 133–34, states so definitely.

[2] Bartlett, 1933, p. 15.

	Mean Length in Centimeters	Mean Width in Centimeters	Mean Thickness in Centimeters	Size of Sample
Upper & lower surfaces parallel,				
Finger grips: 0	25.6	11.9	5.0	100
Finger grips: 1 or 2	25.1	10.8	5.1	48
Upper & lower surfaces not parallel ("wedge"),				
Finger grips: 0	26.2	10.9	4.2	92
Finger grips: 1 or 2	23.3	10.5	5.4	26

From these figures it can be seen that the manos that have been worn the thinnest are those without finger grips and used tilted to produce a wedge-shaped cross-section. It was expected, on the basis of preliminary observations, that the manos without finger grips would average considerably longer and narrower than those with finger grips. The actual difference, computed from the measurements, is very slight.

Temporal Changes in Size. See table 6. Chronologically, there are slight variations in size, but it cannot be said that the earlier manos are conspicuously different, and, as far as the manos with single grinding surface are concerned, it would be impossible to separate the earlier from the later by size, if their proveniences were unknown. Comparison of the manos with single grinding surface from P V (Awatovi 17c) with those from 12 earlier sites ranging from Basket Maker III through Pueblo III indicates that the chief difference is that early manos are shorter. An exception to this is the wedge-shaped manos with finger grips, which show no difference.

Table 6: Sizes of Manos with Single Grinding Surface, listed by Chronological Periods

	Mean Length in Centimeters	Mean Width in Centimeters	Mean Thickness in Centimeters	Size of Sample
Sites 4A, 264, BM III-early P I	21.0	11.4	4.8	10
Sites 4A, 263, P I-II	27.9	13.3	6.7	5
Sites 102, 111, P II	23.6	11.8	4.1	5
Site 107, P I-III	23.6	11.0	4.6	5
Sites 104, 105, 108, P II-III	24.2	10.7	5.4	6
Pink Arrow, P III-IV	23.1	10.7	5.6	7
Awatovi, P III (B/W)	25.9	10.7	4.2	9
" P III (W-O)	24.9	13.0	3.9	8
" P III (B/O)	23.3	11.4	3.7	11
" P IV (O-Y)	23.3	10.8	4.0	9
" P IV (B/Y)	23.9	11.0	3.8	53
" P IV (Y-17)	25.5	10.7	4.9	28
" P V (17c)	25.4	11.2	4.8	266
Kawaika-a, P III-IV	25.6	11.2	4.6	10

Taking the manos with single grinding surface as a group regardless of minor variations in form, remarkably little variation in size can be observed from the beginning to end of the 12 centuries covered by our sites. Besides greater length of the later manos, one difference with possible significance was noticed. The manos from earlier occupation of Awatovi, Pueblo III and early Pueblo IV (B/W, W-O, B/O, O-Y), are somewhat thinner than those of earlier or later date. Since the amount of wear determines thickness it could be suggested that some reason such as greater economy in the use of materials or a disinclination to manufacture new manos resulted in longer use of manos during this time.

Material. See table 7. Nearly all are of sandstone, with fine-grained sandstone slightly more abundant than coarse. Other materials used are quartzite, basalt and vesicular tuff, used mostly before Pueblo IV. Coarse sandstone may have replaced them in Pueblo IV and V.

There is a tendency for the wedge-shaped manos, and those with finger grips, to be of fine-grained sandstone, and for coarse sandstone to be used for the manos with faces parallel. If grinding was done on a series of metates, coarse to fine, this indicates a different motion for the first grinding (mano held flat during stroke) from that for the final grinding (forward edge of mano raised, as described above, p. 69). This observation is based mainly on Awatovi Pueblo IV and V specimens, since earlier than this the numbers are too small for satisfactory comparisons.

Coarse sandstone is scarcest in the Pueblo III levels of Awatovi, a fact which may be significant because this is the only time basalt appears in appreciable quantity. In other Pueblo III Jeddito sites it is absent. It is possible that the use of basalt reflects the arrival of people from along the Little Colorado River, since basalt is frequently used there for manos and metates.

Table 7: Percentage of Materials Used for Manos with Single Grinding Surface
(Figures show percentages for site, group of sites, or period)

	SANDSTONE*							
	Fine	Medium	Coarse	Quartzite	Basalt	Limestone	Tuff	Unrecorded†
Sites 264, 4A, BM III-early P I	45	10	30	15	—	—	—	—
Sites, 4A, 263, P I-II	—	25	75	—	—	—	—	—
Sites 4A, 102, 103, 111, 169, P II	13	20	33	7	—	7	—	20
Site 107, P I-III	60	—	40	—	—	—	—	—
Sites 104, 105, 108, P II-III	22	—	78	—	—	—	—	—
Site 231, P III	33	—	33	33	—	—	—	—
Pink Arrow, P III-IV	8	18	30	—	—	—	—	44
Awatovi, P III (B/W, W-O)	33	51	4	—	8	—	4	—
" P III (B/O)	50	39	—	—	6	—	6	—
" P IV (O-Y)	40	36	12	—	4	—	8	—
" P IV (B/Y) A 0††	72	20	6	—	—	—	—	2
" P IV (B/Y) A 1, 2	18	53	21	—	—	—	4	4
" P IV (B/Y) B 0	63	33	4	—	—	—	—	—
" P IV (B/Y) B 1, 2	20	40	35	—	—	—	—	5
" P IV (Y-17) A 0	25	42	25	—	—	—	—	8
" P IV (Y-17) A 1, 2	12	29	35	—	—	—	—	23
" P IV (Y-17) B 0	47	17	33	—	—	—	—	3
" P IV (Y-17) B 1, 2	5	5	78	—	—	—	—	11
" P V (17c) A 0	29	33	31	—	—	—	—	7
" P V (17c) A 1, 2	4	49	40	—	—	1	—	6
" P V (17c) B 0	56	22	17	—	1	—	—	4
" P V (17c) B 1, 2	21	44	33	—	—	—	—	2
" Unassigned	10	25	45	—	—	2	—	18
Kawaika-a, P III-IV	30	5	55	—	5	—	—	5
Percentage of Total Specimens	34	30	28	< 1	< 1	< 1	1	6

* *See* supra p. 55 for discussion of sandstones used for metates. Materials used for Manos are similar.

† Due to oversight in field cataloguing.

†† A indicates Manos with upper and lower faces parallel; B indicates wedge-shaped cross-section. Figures 0, 1, and 2 refer to number of finger grips.

However, the basalt metates at Awatovi are not restricted to any period of the site, although never numerous.

Quartzite was used chiefly in Basket Maker III, at Sites 264 and 4A.

Provenience and Total. See table 8.

Nearly all the manos with single grinding surface, both whole and fragmentary, were found in rubbish dumps. Exceptions found *in situ* are listed here:

Site 4A, Room 18, Basket Maker III pithouse, three manos of coarse sandstone on floor. Room also had two troughed metates and two convex surfaced manos, presumably used with them. There were no metates or grinding slabs on which these three manos would have been suitable.

Table 8: Provenience of Manos with Single Grinding Surface, showing frequency of certain minor variations in shape

	Faces Parallel			Faces Not Parallel			Total
Finger Grips	0	1	2	0	1	2	
Site 264, BM III-early P I	6	1	—	6	1	—	14
Site 264, P II (Room 42)	1	—	—	—	—	—	1
Site 4A, BM III-early P I	6	—	2	—	—	1	9
Site 4A, P II	1	1	1	1	1	—	5
Site 102, P II	2	—	—	1	1	—	4
Site 111, P II	1	—	—	1	1	—	3
Site 169, P II	—	—	—	3	—	—	3
Site 263, P I-II	1	—	1	—	—	—	2
Site 104, P II-III	1	—	1	—	1	—	3
Site 105, P II-III	—	—	—	1	1	—	2
Site 108, P II-III	1	1	1	—	—	1	4
Site 231, P III	1	—	—	2	—	—	3
Site 107, P I-III	5	1	1	1	2	—	10
Pink Arrow, P III-IV	13	—	1	9	4	—	27
Awatovi, P III (B/W)	8	—	2	3	—	1	14
" P III (W-O)	7	1	5	—	—	—	13
" P III (B/O)	8	1	4	3	1	1	18
" P IV (O-Y)	8	4	7	3	1	2	25
" P IV (B/Y)	47	6	22	24	13	7	119
" P IV (Y-17)	24	6	11	36	9	9	93
" P V (17c)	183	37	36	191	37	16	504
" Unassigned	9	5	11	9	2	4	40
Kawaika-a, P III-IV	7	—	2	7	2	2	20
Total	340	64	108	301	77	44	936

Site 4A, Room 1, Pueblo I, mano on floor.

Site 4A, Room 6, Pueblo II, mano on floor.

Site 102, Room 2, Pueblo II, four manos on floor or just above it.

Awatovi, Pueblo III (B/W): Mano on lower floor of Room 207. Mano used in masonry of north wall of Room 312.

Awatovi, Pueblo III (B/O): Mano on floor of Room 303.

Awatovi, Pueblo IV (B/Y): Mano in fill of Test 26, 50–100 centimeters, with flat metate of the same coarse sandstone. Probably used together.

Awatovi, Pueblo V (17c): Two manos on floor of Room 36. Mano in storage bin in southeast corner of Test 46, Room 1, with three metates, some charred corn and several manos of other shapes. Mano on floor of Room 515. Two manos used to reduce size of opening into fireplace in Test 5; any other handy pieces of stone of suitable size could as well have been plastered into floor. Niche in south wall of Test 5 contained two manos, two more on floor (see p. 57 for description of this room and metates in it). Mano on floor of Room 402. Mano on floor of Room 403.

Women from the nearby Hopi towns visited the expedition camp and collected a large number of manos which had been catalogued and were not being saved for shipment. The Hopi women generally preferred manos that were considerably worn but still thick enough for a great deal more use. Manos were usually selected to go with a previously chosen metate, the mano being tried for length and for fit of grinding surface. No preferences were noted as to finger grips or number and position of grinding surfaces.

MANOS WITH TWO ADJOINING GRINDING SURFACES

FIGURE 17, *e*, *f*.

Definition. A mano with two flat grinding surfaces on the same face at a slight angle to each other. The opposite face is not used for grinding.

Shape. Rounded-rectangular to oval, or sometimes irregular. Edges are approximately parallel in most specimens, and ends rounded. Frequently the shape is somewhat altered by breaks along a thin edge or was left irregular in the original shaping of the implements.

Transverse Cross-section. Varies from triangular (two grinding surfaces meeting at an obtuse angle and the opposite face approximately flat) to rounded with edges not yet worn thin. Upper surface is usually pecked but not ground, and is rounded slightly. It is unsatisfactory to describe the shape merely as "triangular" since some of the manos with one or three grinding surfaces might be so described. The second grinding surface may be extremely narrow, as in figure 17, *f*.

Longitudinal Cross-section. Almost rectangular, since the thickness is nearly uniform the whole length, the grinding surfaces flat from end to end and the upper face nearly so. Ends are squared or rounded.

Grinding Surfaces. The two grinding surfaces are the result of using a mano in a slightly tilted position, and occasionally turning it horizontally end for end. If the mano shown in figure 7, *a* were turned around and wear commenced on the other half of the lower face, two adjoining grinding surfaces would eventually be seen. The wear is greatest near the edges, often more on one grinding surface

TABLE 9: Percentage of Materials and Provenience of Manos with Two Adjoining Grinding Surfaces

(Materials are shown as percentage of total for site or period)

	SANDSTONE*							
	Fine	Medium	Coarse	Basalt	Quartzite	Tuff	Unrecorded	Total
Site 264, BM III-early P I	—	—	100	—	—	—	—	1
Site 4A, P I-II	—	100	—	—	—	—	—	1
Site 111, P II	75	—	25	—	—	—	—	4
Site 103, P II	—	100	—	—	—	—	—	1
Site 104, P II-III	100	—	—	—	—	—	—	1
Site 105, P II-III	100	—	—	—	—	—	—	1
Site 108, P II-III	50	—	50	—	—	—	—	2
Site 231, P III	100	—	—	—	—	—	—	1
Site 107, P I-III	60	—	40	—	—	—	—	5
Pink Arrow, P III-IV	50	17	—	—	—	—	33	6
Awatovi, P III (B/W)	92	—	—	8	—	—	—	12
" P III (W-O)	94	6	—	—	—	—	—	18
" P III (B/O)	40	50	10	—	—	—	—	10
" P IV (O-Y)	83	17	—	—	—	—	—	12
" P IV (B-Y)	73	18	4	2	—	4	—	53
" P IV (Y-17)	53	22	19	—	—	—	6	35
" P V (17c)	53	23	19	—	2	—	2	95
" Unassigned	54	31	15	—	—	—	—	13
Kawaika-a, P III-IV	75	—	25	—	—	—	—	4
Percentage of Total Specimens	65	19	13	1	1	1	2	100
Total								275

* *See* p. 55 for description of sandstones.

than the other. In some instances the two surfaces are very poorly differentiated, appearing almost like a single surface transversely convex. This would be caused by varying the amount of tilt instead of always grinding with the mano at the same angle. The angle at which the grinding surfaces meet varies from almost 180° to as little at 110°, but is usually between 140° and 160°. The amount of wear determines whether the long edges are thick or thin. When thick, the pecking by which they were originally shaped can be seen. When thin, they are often irregular due to minor breaks.

Finger Grips. Present in only 9 per cent of these manos, and about evenly divided between single (one edge only) and double (both edges). They are present on about the same number of coarse- and fine-grained manos. Since many edges are so thin, finger grips formerly present would have been worn away.

Size.	Mean	Maximum	Minimum
Length	26.7 cm.	40 cm.	17 cm.
Width	9.9 cm.	13 cm.	6 cm.
Thickness	3.2 cm.	7 cm.	1 cm.

These manos are longer, narrower and thinner than Manos with Single Grinding Surface. The thinness might result from a tendency to tilt already thinner manos to avoid scraping the fingers on the metate. Thicker manos could as conveniently be used flat.

Material. See table 9. The majority are of fine-grained sandstone, with medium- and coarse-grained next in frequency. Very few are of basalt, quartzite and tuff. There is no particular chronological difference in the preferences for materials.

Provenience and Total. See table 9. All but the following were found in rubbish fill:

Awatovi, Pueblo III (B/W): mano in masonry of east wall of Room 330.

Awatovi, Pueblo IV (B/Y): mano on floor of Room 59, broken but complete.

Awatovi, Pueblo V (17c): Mano on floor near south wall, Test 5; shown in figure 17, *f*. See description of this room and its contents, p. 57. Mano on floor of Room 403.

MANOS WITH TWO OPPOSITE GRINDING SURFACES

FIGURE 17, *g*, *h*.

Definition. Manos used on both faces for grinding. Some have faces parallel, but majority are wedge-shaped in cross-section.

Shape. Rectangular to oval. Many of those with grinding surfaces not parallel are curved along the edge where the two surfaces meet and approximately straight along the other edge (fig. 17, *h*). This asymmetry is probably the result of wear.

Transverse Cross-section. Faces are parallel on 34 per cent. The rest have a wedge-shaped cross-section. On some the grinding surfaces meet to form a sharp edge, and in others, which have been less worn, the edge is still thick.

Longitudinal Cross-section. Same as Manos with Two Adjoining Grinding Surfaces.

Grinding Surfaces. The distinctive shape of the mano results from turning over a mano with a single grinding surface and developing a new grinding surface on the opposite face. Whether they are parallel or not depends on the factor of tilting already discussed in relation to Manos with Single Grinding Surface.

Finger Grips. Present on 35 per cent. Almost exactly the same proportion of parallel-surfaced and wedge-shaped manos have them. However, on parallel-surfaced manos the finger grip is usually double, and on the others single, since the second grip would wear away as the edge became thin. Probably very few manos were originally made with only a single finger grip. Almost none of these manos from the earlier sites have finger grips, but they were present on this type in all the periods at Awatovi.

Size.	Mean	Maximum	Minimum
Length	24.9 cm.	36 cm.	16 cm.
Width	10.9 cm.	15 cm.	7 cm.
Thickness	4.4 cm.	9 cm.	1 cm.

No significant chronological differences in size were observed.

Material. See table 10. Nearly all are of sandstone, with about equal proportions of fine, medium and coarse texture. Chronologically, there is no great variation in materials, although it appears that there was a preference for fine grained material at Awatovi in Pueblo III and early Pueblo IV (B/W, W-O, B/O, O/Y), as compared to the later periods at Awatovi and also the small sites of earlier date.

The association of finger grips with coarse-grained material, already noticed for Manos

Table 10: Percentage of Material and Provenience of Manos with Two Opposite Grinding Surfaces

(Materials are shown as percentage of total for site or period)

	SANDSTONE*								
	Fine	Medium	Coarse	Basalt	Quartzite	Tuff	Limestone	Unrecorded	Total
Site 264, BM III-early P I	—	—	100	—	—	—	—	—	2
Site 4A, P I-II	33	33	—	—	—	—	—	33	3
Site 4A, Unassigned	—	100	—	—	—	—	—	—	1
Site 263, P I-II	100	—	—	—	—	—	—	—	1
Site 103, P II	100	—	—	—	—	—	—	—	1
Site 111, P II	29	—	29	—	29	—	14	—	7
Site 169, P II	—	—	—	—	—	—	—	100	1
Site 107, P I-III	20	—	80	—	—	—	—	—	5
Site 105, P II-III	—	—	100	—	—	—	—	—	1
Site 231, P III	—	—	100	—	—	—	—	—	1
Pink Arrow, P III-IV	40	10	20	—	—	—	—	30	10
Awatovi, P III (B/W)	50	—	—	25	—	25	—	—	4
" P III (W-O)	50	17	17	17	—	—	—	—	6
" P III (B/O)	36	43	7	14	—	—	—	—	14
" P IV (O-Y)	50	17	33	—	—	—	—	—	12
" P IV (B/Y)	32	40	21	4	—	3	—	—	72
" P IV (Y-17)	18	24	33	2	—	—	2	21	49
" P V (17c)	31	29	34	1	—	—	—	5	296
" Unassigned	9	13	56	—	—	—	—	22	23
Kawaika-a, P III-IV	38	12	50	—	—	—	—	—	8
Percentage of Total Specimens	30	28	32	2	< 1	< 1	< 1	7	100
Total									517

* *See* p. 55 for descriptions of sandstones.

with Single Grinding Surface, is less pronounced in the manos of this type, except in the later occupation of Awatovi (Y-17 and 17c).

Provenience and Total. See table 10. All except the following were found in rubbish fill:

Site 107, Room 11 (Pueblo III ?), two manos in vertical shaft of pithouse ventilator shaft, either by accident or intent. Both are whole, of coarse sandstone.

Awatovi, Pueblo IV (B/Y): Mano on floor of Room 2. Mano on floor (200 centimeter level) of Test 7, Room 2.

Awatovi, Pueblo IV (Y-17): Mano fragment on floor of Test 14, Room 5.

Awatovi, Pueblo V (17c): Mano in storage bin in southeast corner of Test 46, Room 1. Room also contained three flat metates, several other manos, and charred corn.

MANOS WITH THREE GRINDING SURFACES

Figure 17, *i*, *j*.

Definition. Manos with two flat grinding surfaces on the same face and one on the other.

Shape. Approximately rectangular, the sides straight or nearly so and the ends rounded or square. Only the edges and ends preserve the original pecked surface of the implement. Both faces are entirely occupied by the grinding surfaces.

Transverse Cross-section. Very much like that of Manos with Two Adjoining Grinding Surfaces, except that the other face has also been used for grinding. Sometimes one grinding surface of the pair is parallel to the single grinding surface, as in figure 8, *a*. More often the transverse cross-section is nearly symmetrical, as in figure 8, *b* and *c*. The edges are sometimes rather thick, but on many of these manos are worn thin and sharp, resulting in a perfectly triangular cross-section.

Only three manos have all three grinding surfaces on the same face, as shown in figure 8, *d*. They might be regarded as the result of individual experiments, or perhaps the selection for use in a tilted position of a mano that already had been used flat. Since the ultimate form of a mano depends mainly on the motor habits of its user, it is not surprising that there should be some minor variations. Any scheme of classification should be flexible enough to allow for them. As far as the purposes of the miller were concerned, corn might be ground as well one way as another. Local traditions and personal preferences would determine the exact technic. What is more remarkable than an occasional variation in the customary forms of these tools is their degree of uniformity. It implies a corresponding uniformity in the habits responsible for their creation. Indian women seem to have ground corn in relatively few of the many possible ways, and to have persisted in these particular routines over long periods of time.

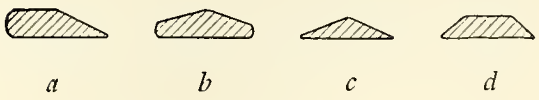

Fig. 8. Cross-sections of Manos with Three Grinding Surfaces.

Longitudinal Cross-section. Similar to Manos with Two Adjoining Grinding Surfaces.

Grinding Surfaces. It cannot be determined whether the two bevelled, or sloping, grinding surfaces were formed after the mano had worn too thin to permit convenient holding in a flat position. If so, originally these manos resembled those with a single grinding surface. Although we cannot be sure of the sequence in which the surfaces were worn, most of these manos probably passed through "stages" at which they had one and then two grinding surfaces. They represent one more slightly different method of using the mano. The choice of method was not entirely personal or accidental, as will be pointed out below, since the different forms of mano occur in varying proportions at different times during the 1200 years of history represented in the Jeddito sites.

Finger Grips. Present on 14 per cent of these manos. The number with one is about equal to the number with two finger grips. In general, manos with one thick and one thin edge have a single finger grip or none at all. When two finger grips are present the mano is relatively thick on both edges. The manos that are worn thin on both edges no longer could have finger grips, even if they were originally present, as they may have been.

There are finger grips on 27 per cent of the manos of coarse-grained sandstone, on 33 per cent of those of medium-, and on only 6 per cent of those of fine-grained sandstone. This agrees with the tendency previously noted for the association of finger grips with coarse rather than fine materials.

Size.	Mean	Maximum	Minimum
Length	25.0 cm.	37 cm.	18 cm.
Width	9.8 cm.	12 cm.	5 cm.
Thickness	3.1 cm.	5 cm.	1 cm.

Thinness might be a reason for tilting these manos when they were used. They are considerably thinner than the manos with single grinding surface or manos with two opposite grinding surfaces. Thickness is about the same as manos with two adjoining grinding surfaces, which, of course, have a pair of grinding surfaces on the same face just as do these. From earlier to later periods there is an increase in both length and thickness, with width showing no change.

Material. See table 11. Fine-grained sandstone is much commoner than the other textures. Quartzite, tuff and limestone make up only a very small proportion. No pronounced chronological changes are noted.

Provenience and Total. See table 11. Only eight of these manos were not found in rubbish fill:

Awatovi, Pueblo IV (B/Y): Mano on floor of Room 261, shown in figure 17, *j*. Mano on floor (200 centimeter level) of Test 7, Room 2. Mano, broken but complete, on floor of Room 59.

Awatovi, Pueblo V (17c): Mano on floor of Test 44, Room 1. Mano fragment on floor of Room 36. Mano fragments in pit under floor of Room 486.

Awatovi, Unassigned (probably Pueblo IV or V): Two manos, both broken but complete, on floor of room in Test 24, Squares C-D.

TABLE 11: Percentage of Materials and Provenience of Manos with Three Grinding Surfaces
(Materials are shown as percentage of totals for site or period)

	SANDSTONE*							
	Fine	Medium	Coarse	Quartzite	Tuff	Limestone	Unrecorded	Total
Site 4, P II	100	–	–	–	–	–	–	7
Site 102, P II	–	100	–	–	–	–	–	1
Site 111, P II	50	–	–	25	–	25	–	4
Site 104, P II-III	–	–	–	–	100	–	–	1
Site 108, P II-III	–	–	100	–	–	–	–	1
Site 107, P I-III	100	–	–	–	–	–	–	5
Site 231, P III	100	–	–	–	–	–	–	1
Pink Arrow, P III-IV	50	–	40	–	–	–	10	10
Awatovi, P III (B/W)	88	–	12	–	–	–	–	8
" P III (W-O)	88	–	–	–	12	–	–	8
" P III (B/O)	70	15	15	–	–	–	–	17
" P IV (O-Y)	80	15	–	–	5	–	–	20
" P IV (B/Y)	61	23	12	–	2	–	2	64
" P IV (Y-17)	60	13	18	–	–	–	8	39
" P V (17c)	52	16	23	–	1	–	8	107
" Unassigned	30	9	26	–	–	–	35	23
Kawaika-a, P III-IV	56	11	33	–	–	–	–	9
Percentage of Total Specimens	59	14	18	< 1	2	< 1	7	100
Total								319

* *See* p. 55 for description of sandstones.

MANOS WITH FOUR GRINDING SURFACES

FIGURE 17, *k. l.*

Definition. Similar to the manos with two grinding surfaces on one face, except that *both* faces have a pair of adjoining surfaces.

Shape. Oval to rectangular, ends rounded, edges approximately straight except where chipped and broken.

Transverse Cross-section. The four grinding surfaces produce a lozenge-shaped cross-section when there has been sufficient wear to remove practically all of the original edges. Most specimens have not been worn this much, and some of the rounded edge remains.

Longitudinal Cross-section. Similar to manos with two adjoining grinding surfaces.

Grinding Surfaces. On some manos the adjoining surfaces are sharply separated, meeting at angles of about 140°, but on most they meet at a greater angle (that is, they are nearly in the same plane) and are poorly differentiated. Like the manos with three grinding surfaces, these represent further use of manos which previously had one or two grinding surfaces. There was no difference in the grinding methods which produced them.

Finger Grips. Present on 21 per cent of these manos, mostly on those of coarse sandstone.

Size.	Mean	Maximum	Minimum
Length	25.7 cm.	38 cm.	18 cm.
Width	9.9 cm.	12 cm.	8 cm.
Thickness	3.5 cm.	6 cm.	2 cm.

Material.

Fine-grained sandstone	29 per cent
Medium-grained sandstone	27 per cent
Coarse-grained sandstone	40 per cent
Unrecorded	4 per cent

Fine-grained sandstone used for manos from Site 104, Pink Arrow and Awatovi B/O, O-Y, Y-17 and 17c Periods. Coarse sandstone only from Awatovi P IV and P V.

Provenience.		
	Site 104, P II-III	1
	Pink Arrow, P III-IV	2
	Awatovi, P III (B/O)	1
	" P IV (O-Y)	4
	" P IV (B/Y)	5
	" P IV (Y-17)	5
	" P V (17c)	23
	" Unassigned	7
	Total	48

All but one came from rubbish fill:

Awatovi, Pueblo IV (B/Y): mano, broken but complete, on floor of Room 59.

UNUSED MANOS

Description. These pieces of stone have been shaped by pecking, and to judge by their size and shape were intended for use as manos. None has a worn surface, such as would appear if used for grinding, and some are still in a very rough and uneven condition.

Most of them are quite thick, as would be expected of unused implements, but the fact that some are as thin as 2 and 3 centimeters indicates that not all thin manos can be regarded as the result of long-continued wear.

Finger grips have been pecked in both edges of one.

Several are fragments of metates, partly reshaped to serve as manos. There were several manos of the shapes previously described that can be identified as made from metate fragments, because of the survival of a portion of the slightly concave grinding surface of the metate.

Size.	Mean	Maximum	Minimum
Length	26.9 cm.	36 cm.	17 cm.
Width	12.0 cm.	16 cm.	10 cm.
Thickness	5.5 cm.	10 cm.	2 cm.

These dimensions exceed those of the manos that had been completed and used. After further pecking, and wear resulting from use for grinding, they would probably not be appreciably larger than other manos.

Material. Like the finished manos, they are nearly all of sandstone. Coarse-grained and fine-grained sandstone are about equally plentiful. There is one mano of quartzite, from Site 264.

Provenience.		
	Site 264, BM III-early P I	2
	Site 4A, BM III-early P I	1
	Site 107, P I-III	1
	Site 108, P II-III	1
	Pink Arrow, P III-IV	2
	Awatovi, P III (W-O)	2
	" P IV (O-Y)	2
	" P IV (B/Y)	5
	" P IV (Y-17)	4
	" P V (17c)	18
	" Unassigned	2
	Kawaika-a, P III-IV	1
	Total	41

ONE-HAND MANOS

Figure 18, *m–o*.

Definition. Rectangular to oval stones with one or two flat surfaces used for grinding, and one or both ends occasionally used for pounding. It was difficult to separate these tools satisfactorily from Pounding and Rubbing Stones, whose functions would appear to be very similar. In general, though, one-hand manos show greater evidence of intentional shaping and resulting symmetry. They also show relatively little use for pounding. Grinding or rubbing seems to have been their main function, generally with a reciprocal motion. They are shorter than the manos previously described, but otherwise rather similar. I believe that they were used in one hand, since they are too short to allow both hands to grasp them simultaneously with convenience. It was found by inspection of all the varieties of manos that the one-hand manos were distinguished by their oval shape, shortness and relative breadth. Arbitrarily, 16 to 18 centimeters was set as a maximum length, in order to separate the few borderline cases. This arbitrary limit was found most satisfactory, as it excluded from the category of one-hand manos the more slender manos, and most of those with finger grips, while including all the most distinctly oval.

Shape. Oval and occasionally subrectangular, with the edges generally dressed squarely by pecking. Most are carefully shaped, but a few seem to be rough pieces of stone selected for their convenient size and used without attempt at shaping.

Cross-section. Relatively thick, subrectangular. When both faces are used for grinding they are usually nearly parallel. When a single face is used the opposite surface is usually rounded. Almost none have been worn to make the thinner edges sharp, a common condition on manos.

Grinding Surfaces. There is a single grinding surface on 37 per cent. Two grinding surfaces on opposite faces on 56 per cent. Two grinding surfaces on the same face (with occasionally the opposite face used as a third and even a fourth grinding surface) on 7 per cent. In the last instance the grinding surfaces meet at an angle of about 140° to 160°, resulting in a thick triangular or lozenge-shaped cross-section. Most of the grinding surfaces are conspicuously striated across the long axis, indicating that the manos were used for a reciprocal and not a rotary type of grinding.

Finger Grips. Only 7 per cent have finger grips of the sort already described for other manos, consisting of a short groove in one or both edges. They look like fragments of longer manos that have broken and been continued in use. Many of the others, incidentally, may be reused fragments, and a few are apparently made from the scraps of broken metates.

Another type of possible finger grip that occurs in 3 per cent of one-hand manos consists of a pit in one or both faces. These pits would have aided in gripping the stone when it was used as a hammer, a use that the battered ends of a few specimens suggest.

Use. There are traces of red on several, probably remaining after paint was ground. Battering on the ends of some, and the pits on a few, indicate use for pounding, much in the manner of discoidal hammerstones. The latter usually show wear around the entire edge, while the one-hand manos are battered only at the ends, if at all.

There is not enough longitudinal convexity on any of the grinding surfaces to indicate, beyond doubt, that they were used on troughed metates. Some of them may have been so used, being short enough to occupy only the relatively flat bottom of the trough. Their presence in Basket Maker III and Pueblo I, when troughed metates were characteristic, increases this possibility. They would also be suitable for use on some of the unspecialized flat slabs that occur at nearly all sites, except that most such slabs show evidence of rotary grinding.

The difficulty of classifying such implements in a system based primarily on function arises from their multiple uses and generalized form. For the more exacting processes of pecking, a chert or quartzite hammerstone would have been preferable; for the highly specialized task of grinding corn on a metate, a longer mano would be more efficient, as it could be grasped in both hands; and in pulverizing and mixing pigments, a paint-grinder would probably be used if it were available. Nevertheless, a tool such as a one-hand mano could serve in any of these capacities, as well as in other functions for which it might occasionally be needed.

Size.	Mean	Maximum	Minimum
Length	11.7 cm.	18 cm.[3]	5 cm.
Width	8.6 cm.	13 cm.	4 cm.
Thickness	4.0 cm.	8 cm.	2 cm.

The shortness of these implements, when compared to various other forms of manos, is conspicuous, and was a principle criterion for their separation from the other manos. In absolute terms they are narrower than any other manos, but relative to length they are wider, a distinction that is reflected in the prevailing short-oval shape. The manos with single grinding surface, or with two opposite grinding surfaces are thicker than one-hand manos. Other manos are thinner.

Material. Most are of sandstone, about evenly divided among fine, medium and coarse textures. Less than 10 per cent are of other materials: quartzite, basalt, limestone and tuff in decreasing order of frequency. Chronologically, the abundance of fine-grained sandstone increases slightly from earlier to later, while the use of coarse-grained sandstone slightly decreases.

Provenience.		
	Site 264 BM III-early P I	6
	Site 4A BM III-early P I	3
	Site 4 P I-II	2
	Site 4A Unassigned	1
	Site 263 P I-II	2
	Site 102 P II	2
	Site 111 P II	6
	Site 107 P I-III	4
	Site 104 P II-III	2
	Site 108 P II-III	6
	Site 231 P III	2
	Pink Arrow P III-IV	14
	Awatovi, P III (B/W)	13
	" P III (W-O)	5
	" P III (B/O)	5

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[3] As explained in the Definition, 18 centimeters is an arbitrarily chosen maximum limit for this category.

Awatovi,	P IV (O-Y)	12
"	P IV (B/Y)	47
"	P IV (Y-17)	34
"	P V (17c)	121
"	Unassigned	7
Kawaika-a, P III-IV		1
Total		295

Most were found in rubbish and fill. Exceptions as follows:

Site 4, Unit B, West Room (Pueblo II), mano on floor.

Site 4A, D-shaped Kiva (Pueblo II), mano on floor.

Site 102, Room 2 (Pueblo II), mano on floor.

Awatovi, Pueblo III (B/W): Mano used as building stone in wall between Rooms 277 and 280.

Awatovi, Pueblo IV (Y-17): Mano in sipapu of kiva, Test 14, Room 5, perhaps as accidental fill.

Awatovi, Pueblo V (17c): Mano in fireplace in Test 5. See p. 57 for further details of this room. Mano in fill of Room 606, associated with fragmentary grinding slab with which it may have been used. Mano on floor of Room 36.

DEVELOPMENT OF MANOS IN THE JEDDITO AREA

SEE FIGURE 9.

Basket Maker III-Pueblo I. Since metates in use at this time were of the various troughed forms it is not surprising to find a preponderance (54 per cent) of convex surface manos, the shape that was used with them. Strangely, though, there are also numerous manos of the shape that was used later on flat metates. As far as we can tell, flat metates had not yet been invented. Therefore, I believe that the presence of these manos with flat grinding surfaces indicates that some sort of reciprocal grinding was done on the unspecialized flat slabs that are found as well as in troughed metates. The manos used on these rough slabs are not observably different in form from many of those later used on flat metates. Only two minor differences were suggested in the description of Manos with Single Grinding Surface: (1) quartzite rather than sandstone was used for the coarse-textured manos at Site 264 and other early sites, and (2) earlier manos average slightly thicker, suggesting that they were worn less before being discarded. The manos with flat grinding surfaces from Basket Maker III and Pueblo I sites are nearly all worn on only a single face, and about equally divided between those with opposite faces parallel and not parallel. Only a very few manos were used on both faces, and of these none had three or four grinding surfaces. The slight difference between earlier and later flat-surfaced manos suggests that they were used in much the same way on the few flat grinding slabs found at Basket Maker III and Pueblo I sites, as on flat metates.

Pueblo II and Early Pueblo III. With the disappearance of troughed metates, the convex surface manos, of course, cease to be used, although a few turn up as late Pueblo IV, probably because of mixture of earlier rubbish with later. Manos with single grinding surface are about as frequent as before. There is a sharp increase in the number of manos used on both faces and those with two grinding surfaces adjoining on the same face. These are the result of turning the mano over, and of tilting it, as already described in detail. Flat metates were being installed in bins at this time, so the grinding apparatus was becoming much more specialized and efficient. All the shapes of manos used in the 17th century were already in use, so there is no justification for referring, as has been done, to "triangular" manos as characteristic of Pueblo IV or any other single horizon.

Late Pueblo III and Early Pueblo IV. The increase in manos with more than one grinding surface continues, although the single grinding surface remains common. It should be noted that the percentages are almost identical for manos with two adjoining and with three grinding surfaces, through all periods. This may mean that the practice of tilting the mano and wearing two narrow surfaces instead of a single wide one occurred regardless of whether or not the other face of the mano had been used for grinding. The two shapes might have been combined as a single "type" as far as their occupying a "definable historical position" is concerned. Manos with four grinding surfaces constitute but 2 per cent of the total at this time, but they never became more frequent than this in the Jeddito area.

Pueblo IV and V. There is a decline in the proportion of manos with two adjoining grinding surfaces, and with three grinding surfaces. Their places are taken by those with one or with two opposite grinding surfaces. Judging from Bartlett's observations of modern Hopi grinding, this trend may have been reversed again. Without quantitative data, she considers that "the most preferred mano is one which is pronouncedly triangular in cross-section."[4] As far as Awatovi is concerned, the grinding practices of the 17th century would appear to differ in no important aspect from those developed when flat metates and grinding bins first appeared. The persistence, side by side, of the several shapes of manos may mean three things. First, each may be the result of a particular method that was appropriate under certain circumstances, so that no single method could replace the others. Second, each may have served equally well for all the grinding that was done, in spite of the apparent advantages of tilting the mano. Hence the choice of technic would be unimportant, a matter of merely personal or accidental choice. Third, the slight differences in technic may have had some significance unrelated to their mechanical efficiency or convenience. They would have been preserved within minor social or kin groups of the community by the conservative force of tradition. There is little basis on which the archæologist can choose between these possibilities. As always in the interpretation of archæological data, many more questions can be asked than answered. The very asking, however, is worth while, as it sometimes encourages future workers to record details previously deemed insignificant, from which some of these questions can eventually be answered.

Finger Grips. Although the description of each group of manos includes a discussion of finger grips, the data are summarized here. Finger grips are present on some manos in each of our categories, from Basket Maker III through to Pueblo V, although not always in equal abundance. The percentage of manos in each group which have finger grips is as follows:

Convex surface	34 per cent
Single grinding surface	31 per cent
2 adjoining grinding surfaces	9 per cent
2 opposite grinding surfaces	35 per cent
3 grinding surfaces	14 per cent
4 grinding surfaces	21 per cent

They are less frequent on the manos which were tilted than on those used flat, partly because many of these manos have the edges worn very thin and finger grips, if originally present, would now be obliterated.

All of the manos from each chronological period, regardless of shape, were checked for presence of finger grips. They were found to be present in the successive periods in the following percentages:

BM III-early P I		15 per cent
P I-II		21 per cent
P III	(B/W)	17 per cent
	(W-O)	19 per cent
	(B/O)	21 per cent
P IV	(O-Y)	34 per cent
	(B/Y)	32 per cent
	(Y-17)	27 per cent
P V	(17c)	22 per cent

Materials. At no time were materials other than sandstone used for more than a small number of manos. A few of each shape except convex surface manos were made of quartzite, basalt, tuff and limestone.

It has already been noted that manos of coarse-grained sandstone more often had finger grips than did those of fine texture. The only possible reason for this that occurs to me is that manos of coarse texture may have been used for the first grinding, when finger grips would be more necessary than for the manos used in the later regrindings of the meal.

In an effort to determine if there might have been any difference in the grinding methods with manos of different textures, all manos of coarse-grained sandstone were compared with those of fine-grained. Of the manos with single grinding surface, the wedge-shaped ones are more often coarse textured. But the manos that had been used tilted and had two adjoining or three grinding surfaces are predominantly

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[4] Bartlett, 1933, pp. 15–16.

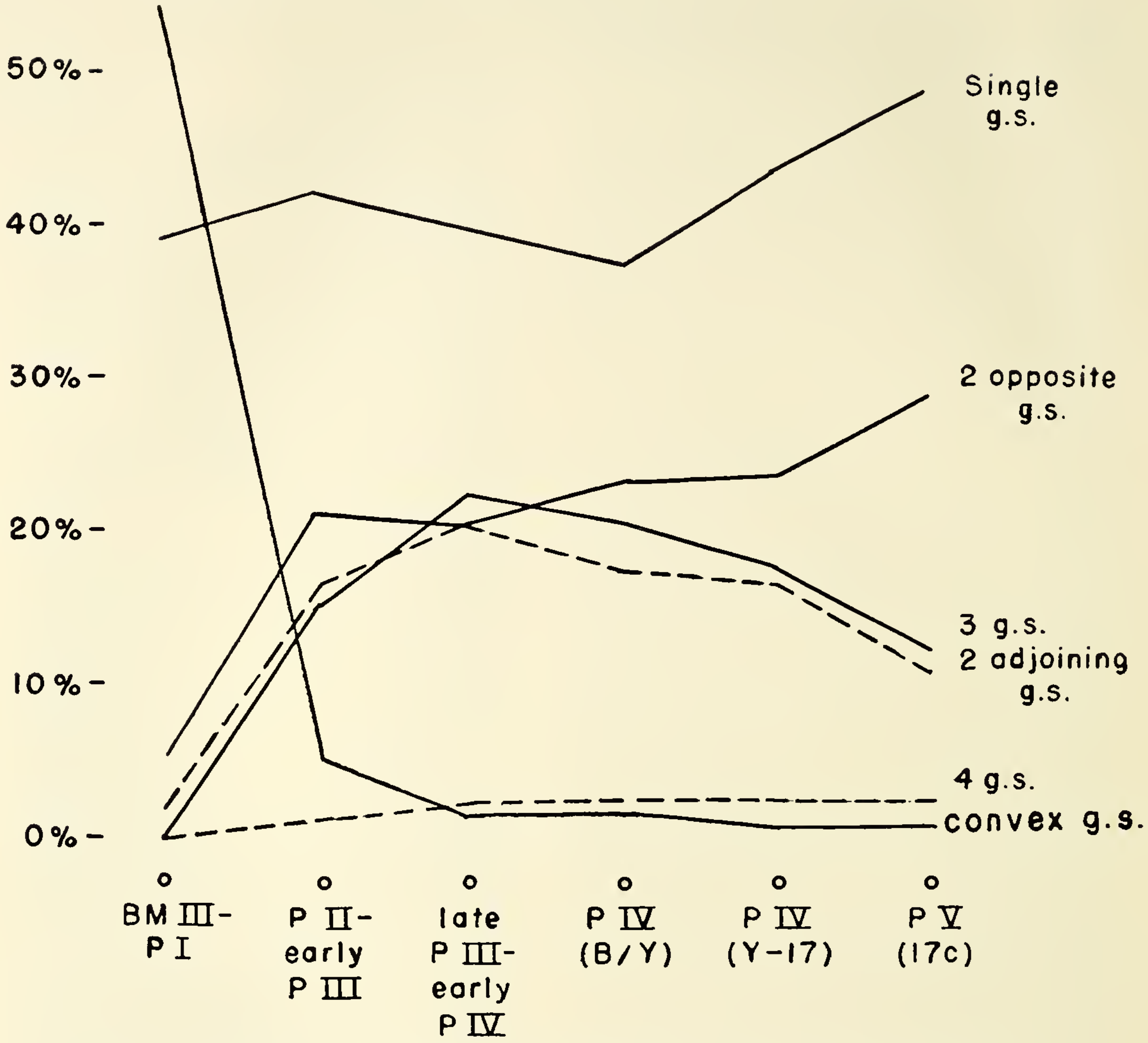

Fig. 9. Graphic Representation of the Frequency of Mano Shapes in Successive Chronological Periods, Jeddito Area.

of the finer textures. Manos with four grinding surfaces are more often coarse than fine textured. Thus no consistent association can be discerned between texture of material and use of the mano in flat or tilted position.

It is generally assumed by Southwestern archæologists that one purpose of setting metates in rows was to provide a gradation in texture from coarse for the initial grinding to fine for the last grinding. This assumption is based on the information we have on modern Pueblo practice. Ordinarily it would be expected that manos would correspond in texture to the metates on which they were used. In the Jeddito sites only a few manos were found in direct association with metates. They indicate that identical textures were not always used together, although some "sets" matched perfectly. I doubt that a mano was always used with the same metate, although the very slight curvature of grinding surfaces makes some combinations fit better than others. Since manos outnumber metates by at least three to one at each period of Awatovi and at Site 264, the only early site with sufficient numbers for comparison, several manos must have been used on each metate, either successively or contemporaneously.

HISTORY OF MANOS IN THE SOUTHWEST

Published data are hopelessly inadequate for any detailed analysis of the areal or temporal distribution of the different forms of manos, or of such traits as finger grips or materials. No more than half a dozen reports on the Pueblo region are sufficiently detailed or sufficiently precise in their terminology to make it possible to reduce their data to common terms. An identification of manos as of "triangular type," without further elaboration, is virtually meaningless.

The "origin" of the mano is chiefly a matter of terminology, since cobbles of convenient size and shape were used for grinding long before the development of more specialized grinding tools. "Mano" is restricted here to the oval or rectangular stones used for a reciprocal type of grinding. Many of the earliest manos are simple in the extreme, and on the borderline of the category as we have defined it. At Shabik'eschee "they were not a highly specialized form purposely made for that definite function, but were as a rule stones of convenient size and shape which could be used with practically no alteration. In fact, the only change apparent is that which may be attributed to use."[5] Most of these I would call one-hand manos.

Somewhat more symmetrical manos, but still shaped mostly by use, are described from Basket Maker III sites in Segi Canyon[6] and from the even earlier White Dog Cave in Marsh Pass.[7] The differences from those at Shabik'eschee may be due as much to the availability of suitable pebbles as to any greater care in shaping.

Manos remained generally an oval or broad rounded rectangle as long as troughed metates were used, but finger grips and a wedge-shaped cross-section both occur. At the following relatively early sites finger grips have been reported:

Chinlee Sites, Basket Maker III
Piedra Sites, Pueblo I and early Pueblo II
Whitewater Village, Pueblo I and II
SU Site, Pinelawn Phase of Mogollon Culture, 4th century
Bear Ruin, Forestdale Phase, contemporary with Basket Maker III

Finger grips are absent on all Hohokam manos, which appear to have undergone less modification than did manos in the Pueblo region.[8] At the time when flat metates appeared in Pueblo II sites, finger grips were fairly common, although never occurring on all manos. Reports are not always clear on this point, but I believe that they were used in all parts of the Pueblo region during Pueblo III and IV. It is impossible to determine from published data whether other sites exhibit the tendency noted at Awatovi for finger grips to occur more commonly on manos of coarse materials and with parallel upper and lower surfaces.

The habit of holding a mano with the far edge tilted up, which produces a triangular cross-section and two grinding surfaces on the same face, also begins early, with convex surface manos. Differences in terminology and the sketchy descriptions in most reports make it impossible to check the development of this habit in the rest of the Southwest to compare it with the Jeddito area. Generally speaking, from the available information, the outline of the development of manos in the Jeddito region seems to apply to the rest of the Pueblo area. Differences doubtless exist, but cannot be detected from published data.

One-hand manos usually lack the specialized features that appear on many of the longer and more slender manos, namely, finger grips and the development of two grinding surfaces on the same face. They retain the multiple purpose character that probably accounts for their ubiquity in the Southwest from the earliest known horizons until the present. Since it is not certain that they were primarily intended for use on metates, they have been omitted from the preceding discussion of the development of manos. Under a great variety of names they have been reported from many sites, and I suspect that they were present at many others for which the reporting of stone implements is vague and incomplete. Such widely used implements tend to be neglected in archæological reporting because they seem to have little chronological significance and do not aid in distinguishing different cultural areas. This unimportance as "index fossils" should not obscure the fact that they may have played important roles in the technology and are, therefore, one more clue to judging the sort of life that was led by their users.

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[5] Roberts, 1929b, p. 133, pl. 26.
[6] Guernsey, 1931, p. 83, pl. 27, *e*, *f*, *g*.
[7] Guernsey and Kidder, 1921, p. 93, pl. 38, *d*, *e*, *f*.
[8] Sayles, 1937, p. 116 and Haury, 1945a, p. 127.

TOOLS FOR POUNDING, PECKING AND RUBBING

PROBLEMS OF CLASSIFICATION

THE large variety of stones which were used for various purposes involving pounding, pecking and rubbing are extremely difficult to describe satisfactorily, avoiding both undue length and insufficient detail. The difficulty arises, first, from our ignorance of just what uses a particular tool may have served, and, second, from the great variety of form among tools that were probably put to identical uses. Therefore, a set of functional categories is not easy to construct and groups which distinguished each form would be far too numerous. The present grouping is a compromise, intended to make possible the description of the implements in fairly concise form, yet including all those data that seem to me most likely to prove significant in historical or functional analyses.

TABLE 12: Terminology of Pounding, Pecking, and Rubbing Tools

This Volume	Morris (1939)	Kidder (1932)	Brew (1946)	Sayles (1937)
Pecking Stones	Pecking Stones	Hammerstones	Hammerstones	Hammerstones
Pounding & Rubbing Stones	Rubbing & Smoothing Stones	Floor polishers	Floor polishers	none
Pebble Pounders	"	Hammerstones	none	Hammerstones
Cylindrical Hammerstones	"	Hammerstones	none	Pestles
Discoidal Hammerstones	none	Floor polishers	none	none (?)
Elongated Pitted Hammerstones	Pitted rubbing & pounding stones	Pitted hammerstones	Pitted hammerstones	none
Paint Grinding Stones	none	none	none	none
Pestles	none	none	none	Pestles
Polishing Pebbles	Pot polishers	Pot polishers	Polishing stones	Polishing stones

It was found impossible to adopt unchanged the categories of any of the more comprehensive archæological reports. In fact, it was remarkably difficult to decide which of the Jeddito tools would be assigned to certain categories of various authors, due to the scanty definitions of their terms. In table 12 I have indicated, as far as I am able, the correspondence between the terms used here and those of several archæologists who have reported stone artifacts with more than usual care.

The terms used here for pounding, pecking and rubbing implements are partly functional and partly descriptive. Functional names would be preferable, perhaps, but many of the tools cannot be certainly identified as to function. These are multiple use tools, often the result of hardly any preliminary shaping, and used as occasion demanded for a considerable variety of purposes. Some are more specialized, the pestles, for example, having been intentionally shaped to a quite distinctive form. In the case of pecking stones, paint grinding stones and polishing pebbles there is little doubt as to their uses. The other tools in this chapter, however, all have the same function, pounding and/or rubbing, and have been separated into several groups on the basis of minor distinctions in shape. Such groups are hardly mutually exclusive, but rather should be regarded as points along a continual range of shapes. If too strictly defined, the groups would exclude a large number of "borderline" cases. Therefore, they have been treated broadly enough to include all the artifacts under consideration. Consequently there is no residual group or "miscellaneous" category.

PECKING STONES

Figure 19, *p–v*.

Description. Stones used for pounding and/or pecking, resulting in battered and worn areas on the surface of the implement. Except for wear resulting from this use, the only shaping of these tools has been a very rough initial breaking by which a chunk of stone of convenient size was obtained. The majority are irregular and unsymmetrical, with the degree of angularity depending on the amount of use. None has been used for rubbing or grinding.

Some are almost spherical with the entire surface worn. These may be termed "globular." Next to these in amount of wear are implements whose shape approximates a thick disk or an oblate spheroid, or which are elongated and angular. On these the protruding portions of the surface are worn and rounded, often chiefly on two ends. A third group has even less wear and greater angularity, having been used only slightly after the initial breaking off of the fragment. These three groups comprise a continuum which begins with the irregular piece of stone not yet used and ends with an almost spherical tool. Specimens can be found to illustrate not only these three stages, but all the intermediate steps, as suggested in the short series illustrated in figure 19, *p–u*. In addition, pecking stones too fragmentary to be assigned to these groups have been tabulated, together with a few large irregular pieces (fig. 19, *v*) apparently used for heavy work. They were probably held in both hands and might be suitable for breaking or dressing building stone.

The percentage of pecking stones in each of these four groups is as follows:

Globular, entire surface worn	16 per cent
Ends worn, moderate degree of wear	44 per cent
Angular, only slightly worn	22 per cent
Fragments and large (2-handed ?)	18 per cent

Size in Centimeters.

	Mean greatest diameter	Mean least diameter	Range of greatest diameter	Range of least diameter
Globular	6.1	4.9	16 to 3	11 to 2
Ends worn	6.6	4.4	17 to 4	9 to 2
Angular	7.2	4.0	16 to 3	10 to 2
Large	9.1	4.3	25 to 4	9 to 2

Percentage of Materials.

	Globular	Ends Worn	Angular	Fragments & Large	Total No. of Specimens
Chert	19	44	31	5	271
Igneous	8	44	23	25	212
Quartzite	22	41	19	18	83
Sandstone	27	42	6	24	66
Petrified Wood	12	65	18	5	17
Limestone	33	—	—	67	3
Concretion	83	—	—	17	6
Unrecorded	8	42	23	27	128

The term chert is used in a broad sense to include such homogeneous siliceous materials as flint, chalcedony, jasper, etc. The sandstone is quartzitic, partly metamorphosed. The petrified wood is brown, banded light to dark, with a columnar structure (fig. 19, *r*).

Provenience.	Globular	Ends Worn	Angular	Fgts & Large	Total
Site 264, BM III-early P I	8	20	6	2	36
Site 264, P II (Room 42)	1	—	—	—	1
Site 4, 4A, BM III-early P I	—	5	2	2	9
Site 4A, P II	—	4	3	2	9
Site 4, Unassigned	—	1	—	—	1
Site 263, P I-II	2	6	—	3	11
Site 107, P I-II	3	—	2	3	8
Site 102, P II	—	1	—	1	2
Site 103, P II	—	1	—	—	1
Site 111, P II	5	17	6	2	30
Site 169, P II	1	1	—	—	2
Site 104, P II-III	1	1	1	2	5
Site 105, P II-III	—	1	—	—	1
Site 108, P II-III	2	7	2	2	13
Site 106, P II	—	1	—	—	1
Site 231, P III	1	—	1	—	2
Pink Arrow, P III-IV	7	6	5	10	28
Awatovi, P III (B/W)	4	15	2	1	22
" P III (W-O)	3	10	1	5	19
" P III (B/O)	3	7	5	—	15
" P IV (O-Y)	5	15	9	9	38
" P IV (B/Y)	24	68	53	25	170
" P IV (Y-17)	16	37	33	23	109
" P V (17c)	39	83	38	39	199
" Unassigned	2	12	6	7	27
Kawaika-a, P III-IV	2	7	3	4	16
Old Shungopovi, P IV-V ?	—	—	1	—	1
Totals	129	326	179	142	776

All pecking stones were found in rubbish fill or on the surface except the following:

Site 4A (Basket Maker III-early Pueblo I), on floor of pithouse, Room 18. The pecking stone was probably used to roughen the grinding surfaces of the manos and metates found on the floor of this room.

Site 264 (Basket Maker III-early Pueblo I), on bench at northwest side of pithouse, Room 16. This room also contained a metate, leaning against the opposite wall, figures 7, *a* and 16, *a*.

Site 4 (Pueblo II), two pecking stones on floor of D-shaped kiva, with a one-hand mano, simple grooved abrader and a pounding and rubbing stone.

Awatovi Pueblo IV (Y-17), a large jar was built into the west end of the south bench of a kiva, Test 14, Room 4, as though for caching ritual paraphernalia or tools. It contained two pecking stones, one globular, of chert, and the other angular, of igneous rock. The only other object in this "cache" was an obsidian scraper.

Awatovi Pueblo IV (Y-17), in a jar built into the northwest corner of the bench of a kiva, Test 14, Room 5, was an angular pecking stone of basalt. In the southwest corner of the kiva, under the bench, was a cache of about fifty stone objects, several painted wooden sticks, and some small animal bones. The stones were mostly sandstone balls. There were four globular pecking stones, not much different from the balls in shape, but apparently shaped by use and not subsequently ground or polished. They probably had served as ordinary pecking stones, and then, when globular stones were needed, they were added to those specially made for this cache. The entire cache was probably ritual in function, as it included a finely carved stone mountain lion. These four pecking stones illustrate well the multiple uses to which stone tools were often put, uses totally unrelated except insofar as the same object might be suitable for both. The term applied for purposes of cataloguing and describing cannot suggest more than a limited part of the total function of the object.

Awatovi Pueblo V (17c), there were four pecking stones (two globular, two worn on ends only) in the sand fill of Room 788. This is the kiva beneath the altar of the main church, intentionally preserved but rendered unusable by filling at the time the church was built.

POUNDING AND RUBBING STONES

Figure 19, *k*, *w*, *b′*.

Description. These tools are shaped almost entirely by wear, and range from very irregular chunks of stone, only little used, to nearly globular or discoidal stones. Each has been used for both pounding (or pecking) as shown by at least one rounded and battered rough surface, and for rubbing, as shown by at least one flat surface, striated or polished. Many of the "floor polishers"[1] found at other sites would fit in this category if they exhibited any evidence of use for pounding or pecking.

In comparison with pecking stones few of this group are globular, since percussion was not their only function. Very few are as angular as the less-used of the pecking stones, probably because such angular stones would seldom be selected for rubbing or smoothing purposes.

Size.	Mean	Maximum	Minimum
Greatest diameter	8.1 cm.	16 cm.	4 cm.
Least diameter	4.5 cm.	9 cm.	1 cm.

About 75 per cent are within the range of 10 to 6 centimeters in greatest diameter, and 5 to 3 centimeters in least diameter.

Material.		
	Chert	7
	Igneous	136
	Quartzite	60
	Sandstone	114
	Petrified Wood	2
	Limestone	2
	Concretion	1
	Unrecorded	83

The materials are similar to those used for pecking stones. All the igneous rock was used at Awatovi, with the exception of three specimens from Site 264, Site 4 and Kawaika-a. The petrified wood was used at Site 4A (Basket Maker III-early Pueblo I) and Awatovi (Pueblo III).

Provenience.		
	Site 264, BM III-early P I	10
	Site 4A, BM III-early P I	2
	Site 4, 4A, P II	2
	Site 4A, Unassigned	1
	Site 102, P II	1
	Site 103, P II	1
	Site 111, P II	2
	Site 263, P I-II	2
	Site 104, P II-III	1
	Site 108, P II-III	2
	Site 231, P III	1
	Site 107, P I-III	3
	Pink Arrow, P III-IV	26
	Awatovi, P III (B/W)	18
	" P III (W-O)	15
	" P III (B/O)	19
	" P IV (O-Y)	22
	" P IV (B/Y)	78
	" P IV (Y-17)	47
	" P V (17c)	124
	" Unassigned	15
	Kawaika-a, P III-IV	12
	Old Shungopovi, P IV-V?	1
	Total	405

All but ten pounding and rubbing stones came from rubbish fill or from the surface:

Site 264, Room 30 (Basket Maker III-early Pueblo I), on bench of pithouse.

Site 4A (Basket Maker III-early Pueblo I), two on floor of Room 18.

Site 4 (Pueblo II), on floor of D-shaped kiva.

Pink Arrow (Pueblo III-IV), in niche in east wall of Room 6, 70 centimeters above floor. Nothing else in niche.

Awatovi Pueblo IV (Y-17), Test 14, Room 5, cache in southwest corner of kiva included five pounding and rubbing stones. This cache has been discussed in connection with the four pecking stones found there, and will be mentioned again under the subjects of carved animals and stone balls.

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[1] Kidder, 1932, pp. 65–66.

PEBBLE POUNDERS

Figure 19, *x*, *y*, *z*, *a'*.

Description. Waterworn pebbles with the ends battered and worn from their use for pounding or pecking. They might properly have been included with those pecking stones which were worn chiefly on the ends or protuberances. They are distinguished from them only by their origin—naturally rounded pebbles, rather than angular fragments of stone. Some are quite small and light, and could not have been used with any great force, due to the necessity of holding them in the fingertips.

Some of these pebbles show a slight amount of use for rubbing and polishing, in addition to battering on the ends. In none did abrasion modify the rounded outlines of the pebble. There are no well developed facets.

Size.

Greatest dimension 7.0 to 14.0 cm.	26
Greatest dimension 4.0 to 6.9 cm.	88
Greatest dimension 2.7 to 3.9 cm.	26
Fragments, original size unknown	14

Material. Nearly all are of quartzite. A few are of basalt, or other igneous material, a few of compact quartzitic sandstone, and a few of metamorphic rocks weathered out of the local conglomerates.

Provenience.	Site 264, BM III-early P I	13
	Site 264 (Room 42), P II	1
	Site 107, P I-III	1
	Site 111, P II	2
	Site 22, P II	1
	Pink Arrow, P III-IV	3
	Awatovi, P III((B/W)	4
	" P III (W-O)	2
	" P III (B/O)	3
	" P IV (O-Y)	5
	" P IV (B/Y)	22
	" P IV (Y-17)	18
	" P V (17c)	65
	" Unassigned	5
	Kawaika-a, P III-IV	9
	Total	154

All but three came from rubbish fill:

Awatovi Pueblo V (17c), in sealed pit under floor of Room 486, with a piece of glass, a few sherds and animal bones, and an unused pebble. These may all have been accidental inclusions in rubbish used to fill the pit.

Awatovi Pueblo V (17c), with Burial 64 in the main Church. No other artifacts, and association possibly fortuitous.

Kawaika-a, in wall niche in kiva, Test 4, Room 7.

CYLINDRICAL HAMMERSTONES

Figure 19, *i*, *j*.

Description. Shaped by pecking to an approximately cylindrical form, usually somewhat flattened in cross-section. The ends are rounded by the wear from pounding. Some are quite nicely shaped, the sides ground smooth, and others are rather irregular and carelessly made. Ten specimens have a flat surface parallel to the long axis, resulting either from use for grinding or from the manufacture of the implement from an old mano.

Tools of this shape are frequently called pestles, and it is quite possible that they were used with mortars. None have been found in such an association, and they are lacking in the earlier horizons from which mortars came. The term pestle has been used only for a highly distinctive implement in this report, and it seems preferable not to apply it to all the tools that might have been used with mortars.

Size.	Mean	Maximum	Minimum
Length	10.2 cm.	14 cm.	6 cm.
Greatest thickness	5.6 cm.	8 cm.	3 cm.

Material.	Igneous	2
	Sandstone	21
	Petrified Wood	2
	Unrecorded	2

The sandstone is compact, partly metamorphosed into quartzite, of fine to medium texture, and color brown or gray. The material is relatively fragile in comparison with chert, quartzite and basalt. Its predominance for this particular tool increases the possibility that they were used for relatively delicate work, such as crushing food, rather than stone working. Tools used on fibres and seeds, if used with a crushing and rocking motion would be subject to far less violent wear than those used in pecking stone tools.

Provenience.	Site 4A, Unassigned		1
	Pink Arrow, P III-IV		2
	Awatovi,	P III (B/O)	3
	"	P IV (B/Y)	3
	"	P V (17c)	15
	"	Unassigned	3
	Total		27

DISCOIDAL HAMMERSTONES

Figure 19, *l*, *m*, *n*, *o*.

Description. Disks or flattened ovoids shaped mainly by use. The circumference is worn down by use of the tool for pounding. One or both faces have usually been flattened by rubbing or grinding. The more elongated specimens merge into the category of one-hand manos as far as shape is concerned. Any implement showing fairly extensive use for pounding, however, has been classed as a hammerstone.

The edge of the discoidal hammerstones, as viewed in cross-section (fig. 10) may be either bevelled from both sides, or rounded. The bevelling is probably the result of holding the stone always at the same angle when in use. If held at various angles the edge would become rounded.

A few discoidal hammerstones not only have a flat rubbing surface, but are made of such hard, fine-grained materials (quartzite and basalt) that the surface has become highly polished. Such a surface would not be produced by, or serve efficiently for, the coarse abrasion involved in dressing stone. The term "floor polisher" has been applied to such implements, on the basis of modern use by Pueblo Indians of comparable stones for such a purpose. (See discussion below of Use and Occurrence.) "Floor polishers," as defined by Kidder,[2] differ from many of the discoidal hammerstones included here only in the absence of battered and worn ends on the "floor polishers."

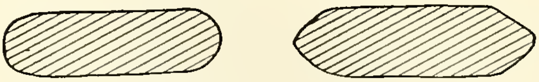

Fig. 10. Cross-sections of discoidal hammerstones.

Fingergrips and Pits. Besides the roughening of the rubbing or grinding surface that can be seen on a few of these tools, there are pits in the center of one or both faces on a few. (Pit in one face of seven, in both faces of two.) These shallow and irregular depressions probably were pecked to serve as grips for the thumb and forefinger to aid in holding the stone. It is also possible that the pits are an incidental result of using these stones as anvils or platforms on which small objects were rested while working on them. Reiter has made some valuable comments on this point.[3] He suggests that intentionally produced fingergrips are probably less common than the accidentally made depressions often referred to by the term.

Size. Greater diameter, mean 7.2 centimeters, maximum 11 centimeters, minimum 4 centimeters. The lesser diameter is seldom more than 1.0 centimeter less than the greater. Thickness is two-thirds to three-quarters of diameter, depending on amount of wear on faces.

Material. Mostly fine-grained very compact sandstone. A few are of quartzite and igneous materials (including those with more highly polished surfaces). Four of the five specimens from Sites 264, 4A and 104 are of quartzite.

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[2] Kidder, 1932, p. 64.

[3] Kluckhohn and Reiter, 1939, p. 59, editorial note.

Provenience.	Site 264,	BM III-early P I	2
	Site 4A,	P II	1
	Site 4A,	Unassigned	1
	Site 104,	P II-III	1
	Pink Arrow,	P III-IV	6
	Awatovi,	P III (B/W)	3
	"	P III (B/O)	1
	"	P III (W-O)	1
	"	P IV (O-Y)	6
	Awatovi,	P IV (B/Y)	14
	"	P IV (Y-17)	8
	"	P V (17c)	29
	"	Unassigned	5
	Kawaika-a		2
	Total		90

All but one came from rubbish fill:

Awatovi Pueblo IV (B/Y), on floor of Room 324.

ELONGATED PITTED HAMMERSTONES

Figure 19, *h*.

Description. Elongated with a round to squarish cross-section. Ends worn from use in hammering or pecking. One or more somewhat flattened longitudinal surfaces, the result of secondary use for rubbing or grinding. A pair of shallow, irregular pits pecked in opposite faces, probably to aid in holding the stone when it was used for pecking or pounding.

Similar pits occur in a few discoidal hammerstones, but not usually in pairs. Cylindrical hammerstones lack such pits and are more carefully shaped to a cylindrical form. Although there are few elongated pitted hammerstones, they are sufficiently like each other and different from any other implements to merit listing as a separate shape.

Size. Mean length 10.0 centimeters. All but two are between 8 and 11 centimeters long.

Material. Basalt, quartzite and fine-grained sandstone.

Provenience.	Site 264,	BM III-early P I	1
	Site 263,	P I-II	1
	Site 108,	P II-III	1
	Awatovi,	P III (W-O)	2
	"	P IV (B/Y)	2
	"	P IV (Y-17)	1
	"	P V (17c)	7
	Total		15

USE AND OCCURRENCE OF POUNDING, PECKING AND RUBBING STONES IN THE SOUTHWEST

> The number of small stones showing pecking or artificial working which can be picked up at a Southwestern ruin is much larger than the proportion in collections would seem to indicate. From their great weight, as well as their numbers, the majority have been left behind, and as a rule those which are destitute of special form are rejected. It was apparently the Indian custom to pick up any stone near at hand, to use it for pounding or other purposes as long as needed, and then to cast it away. It thus happens that innumerable stones, slightly pecked on one or all sides, but without the form of any implement, are very numerous upon the mounds of almost every ruin.[4]

Fewkes wrote the foregoing remarks with special reference to Fourmile Ruin, but similar statements have been made about a great many other sites. For example, at White Mound Village, "The commonest stone implements were hammerstones, fashioned from a fist-sized rock, rounded from use."[5] The same is true on the New Mexico-Colorado boundary. "The type of stone implement found with the greatest frequency at sites of all ages in the La Plata country is the variety of hand hammer that I have elsewhere referred to as the pecking stone."[6]

These unspecialized tools for pounding and rubbing are common enough at nearly all sites in the Southwest to suggest a considerable importance in the daily life of the people. But being multiple purpose tools they are not greatly specialized in any particular direction, and their variety and large numbers have not resulted in a corresponding degree of attention being paid them by archæologists. Under many names these tools are reported from enough sites to suggest that apparent absences elsewhere are only because authors have succumbed to the temptation of describing only the unusual and ignoring the commonplace.

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[4] Fewkes, 1904, p. 159.

[5] Gladwin, 1945, p. 26.

[6] Morris, 1939, p. 128.

I have been unable to make the distinctions used in the preceding descriptions in reviewing a great part of the published data. Too many undefined terms are used and too few detailed descriptions given. Consequently it is not possible to say just what forms of pounding, pecking and rubbing stones are characteristic of particular areas or centuries. Changes have probably taken place, but they are slight, and will not be detected until we have more adequate descriptions.

For the Jeddito area one interesting bit of information on chronological changes was secured. The relative abundance of pecking stones at different periods was computed. Contrary to expectations, their use seems to have declined after Pueblo II times. They were least frequent in Pueblo V. The introduction of Spanish knives and axes of iron would hardly be expected to have caused any great reduction in the working of stone, since there were many other implements to be made, and building stone to be prepared. It may be that the decline in the number of pecking stones is partly the result of the many discarded axes that were put into use, as pointed out in connection with Uses of Axes. The following figures show the number of pecking stones for each period as a percentage of the total implements for that period from all Jeddito sites.

Basket Maker III-early Pueblo I	18 per cent
Pueblo I-II	21 per cent
Pueblo II	27 per cent
Pueblo II-III	23 per cent
Pueblo III	12 per cent
Pueblo IV	13 per cent
Pueblo V	6 per cent

Although a number of the uses of pecking stones, pounding and rubbing stones, etc., have been alluded to in the course of describing them, it seems worthwhile to bring together here all the possible uses that have been suggested by various authors. No single implement need be imagined as having been put to all these uses, but tools in the groups that have been described in preceding paragraphs were probably used in each of these ways. Many grooved axes and hammers, it should be mentioned, also served some of these functions.

1) *The manufacture of stone tools by pecking.* Traces of this pecking are visible on many axes, metates, manos, etc., and nearly all the larger tools were probably shaped by this method. This was an important and continuing activity, and it is not surprising that most of the pecking stones appear to have been put to no other uses. The manufacture of stone tools still continues in the Pueblos, although dying out. Hough wrote of the Hopi, "The handstones for grinding corn are still made, and a woman pecking away at one with a stone hammer is not infrequently seen and heard."[7] Reiter has discussed with considerable insight the relation of form to function in these pecking stones. In part, he says:

> The majority of the blunt surfaced hammerstones are chipped around the circumference of the blunt face. When ends are reversed these (generally conchoidal) fracture areas, admittedly, do feel different and restful, to the hand. . . . Too much of this chipping *around* one end results in an uncertainty of grip due to fatigue, and to slipperiness of perspiration on the newly broken and rather slick surfaces. An eroded or "battered" rough surface is more comfortable over a long period, and more accurate in use. . . . In my estimation, these spherical models constitute the streamlined acme of hammerstone perfection; they are heavier, offer more variety of grip (they are more restful), and the chances of edge-splintering . . . are minimal. The spherical specimens, of course, usually offer no localized percussive area for directional blows.[8]

2) *Crushing minerals for paint or for pottery temper.* Stevenson wrote in 1883, probably referring to Zuñi, "On more than one occasion I have seen a woman using the edge

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[7] Hough, 1915, p. 88. See also Hough, 1897 for a description and illustration of the manufacture of a mano with a pecking stone. From personal observation it can be stated that the making of manos and metates has become a quite rare event among the Hopi.

[8] Kluckhohn and Reiter, 1939, pp. 59–60, editorial note.

of a handsome stone axe in pulverizing volcanic rock to mix with clay for making pottery."[9]

3) *Pecking the grinding surfaces of metates and manos to roughen them, for more effective grinding.* Some metates still bear the marks of this pecking, as can be seen in figure 16, *e*. It is this, as well as the actual grinding, of course, that wears metates and manos thin. In one of the rooms at Awatovi where metates and manos were found in considerable numbers, there was a wall niche containing two manos and a stone axe worn down as though from pecking. Pecking stones were found with manos or metates at Sites 4, 4A and 264, as reported above under Provenience of pecking stones.

4) *Crushing seeds and vegetable fibres.* At Oraibi in 1904, "They commenced to make suds in two large bowls of yucca plant roots that were first mashed by stones."[10] Stevenson collected at Nambe "pounding stones, chiefly of quartzite . . . regularly formed, cylindrical or spindle-shaped, with blunt or squarely docked ends, from 4 to 7 inches long and 2 to 3 inches in diameter, used chiefly in pounding mesquite beans."[11] It would be quite correct to refer to such tools as pestles, provided they were used in mortars. Similar tools have been called cylindrical hammerstones here, since there is no certainty that they were not used in many other ways besides serving as pestles.

5) *Preparing hides by pounding and rubbing*, as suggested by Guernsey and Kidder to explain the polish on an implement from White Dog Cave.[12] An interesting confirmation of this suggestion comes from an observation made at Mishongnovi at the beginning of this century. "The Chief Snake priest continued his work on the manufacture of a pair of moccasins. . . . At this particular time he happened to be pounding a heavy piece of rawhide upon the floor by means of a rough undressed piece of stone."[13]

6) *Dressing building stones.*[14] The larger pecking stones would be suitable for the initial breaking. Pecking stones and pounding and rubbing stones would serve for the final shaping and smoothing. Not all masonry was carefully finished, but some walls at Awatovi were ground smooth after the stones were in place.

7) *Smoothing and bonding plaster on walls and floors.* In recent years at Sia Pueblo floors were made of a mixture of clay and earth. After levelling, the surfaces were stamped by foot. "When the floor is as smooth as it can be made by stamping, the pounders go to work, each one with a stone flat on one side and smooth as a polishing stone. Many such specimens have been obtained from the ruins in the Southwest."[15] A layer of clay, spread by hand, and sometimes a coating of beef or goat blood complete the floor, in Sia practice. A Hopi informant, from Second Mesa, identified for me the discoidal hammerstones in figure 19, *m*, *n*, and *o* as "just like" the floor smoothing stones used at present. Unfortunately, I did not see any of the stones themselves. Jeançon also refers to this process, but without details.[16] The implement he identifies as a floor-polisher looks much like some of the Awatovi pounding and rubbing stones, and many of the discoidal hammerstones could also have been so used.

8) *Grinding and polishing axes.*[17] This is speculation, as no account of such use comes from the ethnographic data. The fine polish of the better axes could not have been achieved with such coarse abrasives as pumice and sandstone. Some of the igneous and metamorphic pebbles that were worn by abrasion could have been used in the polishing of stone axes and hammers.

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[9] J. Stevenson, 1883a, p. 320.

[10] Voth, 1912, p. 148.

[11] J. Stevenson, 1883b, p. 436.

[12] Guernsey and Kidder, 1921, p. 93.

[13] Dorsey and Voth, 1902, p. 225.

[14] Morris, 1939, p. 128.

[15] M. C. Stevenson, 1894, p. 24.

[16] Jeançon, 1923, p. 21, pl. 17B.

[17] Brew, 1946, p. 237.

PAINT GRINDING STONES

Figure 19, *a–g*.

Description. All possess a single smooth surface, very slightly convex, which cuts across an ovoid or conical stone. Surface is highly polished, marked by minute striations indicating use in a back-and-forth rubbing motion in several different directions.

Shape. Many are cobbles with polished surface perpendicular to what had been the longer axis. Others are conical, or somewhat cubical, and have been pecked and ground to approximately symmetrical shape. Grinding surface round, oval or subrectangular.

Paint. Out of 64 of these tools, 15 still have paint on the grinding surface or on the edges immediately adjoining it. Since the others, lacking paint, are of similar form, the same use is inferred for all of them. Figure 19, *g* is one of the specimens with the most paint. It is concentrated on an area about 1 centimeter wide on the sides, just above the grinding surface. This is where the paint would collect if the stone were immersed to this depth in a liquid, or if the paint were a thick paste. Paint grinders of exactly this form were in use by the Hopi in the 19th century. They are discussed at greater length in connection with palettes. Color of the paint on the 15 implements was blue-green on 11, yellow on 2, both yellow and green on 2.

Use on Grinding Slabs. Three paint grinding stones were found with the slabs on which they had been used:

1) Figure 19, *g*, on floor of Room 753, Awatovi (Pueblo V), with grinding slab of fine grained sandstone 29 by 27 by 6 centimeters, squared on three sides, the fourth broken. One face of slab worn smooth, with slight concavity in center. Fragment of malachite found with the slab and grinder, making the set complete.

2) Kawaika-a, Test 5, Room 2, in fill at 50–100 centimeter level (floor at 180 centimeters). Paint grinding stone found with slab of fine sandstone, roughly triangular, edges uneven but partly smoothed, 23 to 20 by 6 centimeters. One face of slab worn smooth, with slight depression 10 by 8 centimeters, about 0.5 centimeters deep. Green paint still on grinding slab. These implements in fill, but together.

3) Figure 19, *c*, on floor of Room 59, Awatovi, P IV (B/Y). It was with piece of malachite and large slab, described in field notes as "a large stone slab on which it was used." Unfortunately slab was not catalogued nor were further details recorded.

Size.	Mean	Maximum	Minimum
Height[18]	6.4 cm.	12 cm.	3 cm.
Diameter	6.8 cm.	10 cm.	4 cm.

Material.		
	Igneous	5
	Quartzite	30
	Sandstone, fine-grained	13
	Limestone	11
	Unrecorded	5

Provenience.			
	Site 4A,	Unassigned	1
	Pink Arrow,	P III-IV	1
	Awatovi,	P IV (O-Y)	1
	"	P IV (B/Y)	2
	"	P IV (Y-17)	9
	"	P V (17c)	43
	"	Unassigned	6
	Kawaika-a,	P III-IV	1
	Total		64

Details of two found on floors of Awatovi rooms are given above.

Use and Distribution. The presence of pigment on a great variety of grinding, pounding and rubbing tools indicates that paint was prepared by other kinds of implement besides these paint grinding stones. But these are limited to that special function, and agree in details with the paint grinders of the modern Hopi. In the 1890's A. M. Stephen described the equipment used in making paint as "a shallow oblong stone muller, about a foot long, and a rubbing stone about the size and something of the form of a half a cricket ball."[19]

In the collection of objects which Stevenson made at Walpi (First Mesa) in 1879 are listed five "quartzite paint pestles made from half-sections of small semispherical boulders; the large end, which is flat, being used for the grinding part."[20] Some of the Awatovi implements fit this description perfectly.

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[18] Height measured perpendicular to grinding surface.

[19] Parsons, 1936b, p. 1192.

It is interesting that several paint grinders were made of limestone, a material rarely used for tools in the Jeddito region. It occurs in the vicinity in Tertiary formations.

Only a few artifacts which might be regarded as similar to these paint grinding stones have been reported in the literature. At Spruce Tree House[21] there was a "conical stone" somewhat more elongated than the Awatovi specimens. An object at Aztec Ruin[22] is said to have been used for pounding, but has a shape suggestive of paint grinding stones. At the Village of the Great Kivas "the pestles used in grinding pigments are cylindrical stones with flattened ends,"[23] which is not very different. A specimen identical with those from Awatovi was found at Sikyatki, by Fewkes.[24] Another almost identical implement was found at Casa Grande, with the paint still adhering to it.[25] It is quite possible that similar tools have been found elsewhere, but not recognized as distinctive, and not reported except by general references to "rubbing stones." Any generalizations about origin or distribution must await further information, but at present this kind of tool seems to be characteristic only of the Hopi region.

PESTLES

Figure 18, *a–f*.

General Remarks. Although any implement for the pounding and crushing of such substances as food, pigments, pottery materials, dyes, etc., can be termed a pestle, it seems preferable to limit the term to artifacts of a specialized shape, and to exclude the very generalized sorts of pounding and rubbing stones. The pestles found at Awatovi have a large end, sometimes rounded and sometimes rectangular, and a more slender cylindrical handle. They occur mainly in Pueblo V and there are a few from Pueblo IV. No comparable pestles are known from other Southwestern sites. Their use is unknown and none were found under conditions offering any indications of what their function may have been. They are mostly of sandstone, rather fragile, and show relatively little wear. A Hopi informant questioned at Second Mesa in 1947 did not recognize them as anything now in use, or known to him. The tools which he said were used for crushing chili and melon seeds were like the cylindrical hammerstones already described. The term pestle is, therefore, applied to this group of implements with some hesitation. Such a use seems the most probable, although it is not impossible that they might even have served some symbolic function in Hopi ritual, the complexity of which is such that almost no unusual object would appear out of place on an altar or shrine.

Definition. Objects of unknown use which may have served as pestles. They resemble the tools sometimes called "Potato Masher Pestles" in archæological literature outside the Southwest. The large "head" and the smaller "handle" are separated by a well defined shoulder.

Shape. Although varying in symmetry and excellence of finish, each has a large end, or head, which is either globular or partly squared, and a small end which is cylindrical or slightly tapered. The handle, or small end, joins the head at a shoulder, which is usually somewhat sloped or rounded. The head and handle are of about equal length.

Cross-section. The head is oval or rectangular in horizontal cross-section, and the handle approximately circular. The diameter of the handle is only slightly less than of the head.

Workmanship and wear. Shaped by pecking and grinding. Only four are completely symmetrical. The poorest finish is on a very irregular specimen, figure 18, *d*. This is also the oldest of the pestles, coming from the mid-Pueblo IV horizon (Awatovi B/Y).

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[20] J. Stevenson, 1883a, p. 378.

[21] Fewkes, 1909, p. 41, fig. 13.

[22] Morris, 1919, p. 20, fig. 7, *d*.

[23] Roberts, 1932, p. 142, pl. 155, *a, b*.

[24] U. S. National Museum collections, no. 156145.

[25] Fewkes, 1912, p. 127, fig. 30.

Size.	Mean	Maximum	Minimum
Length	16.3 cm.	21 cm.	11 cm.
Width	9.1 cm.	12 cm.	7 cm.

The length of about two-thirds of the pestles is 16 to 18 centimeters.

Material.	Sandstone	20
	Basalt	3
	Unrecorded	2

The sandstone is fine-grained, compact, yellow-brown, much less durable than the basalts, cherts and quartzites used for most of the pounding and pecking stones. However, a rocking or crushing motion would probably not wear them out very rapidly.

Provenience.	Awatovi,	P IV (B/Y)	1
	"	P IV (Y-17)	3
	"	P V (17c)	20
	"	Unassigned	1
	Total		25

Use and Distribution. No artifacts quite like these Awatovi pestles have been reported elsewhere in the Southwest. Most of the tools called pestles are more or less cylindrical, and are not shouldered. Outside the Pueblo region, in central and southern Arizona and New Mexico, there are a few "pear-shaped" and "bell-shaped" pestles:

Roosevelt 9:6, Colonial Hohokam (Haury, 1932, p. 94, pl. XVI, A)
Snaketown, Colonial Hohokam (Sayles, 1937, pl. LI)
Swarts Ruin (Cosgrove, 1932, p. 34, pl. 43, *d*, *e*)
Cameron Creek (Bradfield, 1931, p. 126, pl. 106)
Texas Canyon, near Dragoon (Fulton, 1934, p. 21, pl. 18, *b*, *e;* Fulton, 1938, p. 18)
Tres Alamos (Tuthill, 1947, p. 77, pl. 29, *d*, *e*)
Ramos, Phase, Chihuahua (Sayles, 1936, pl. 15)
Los Muertos, Classic Hohokam, a single doubtful example (Haury, 1945a, p. 129, pl. 37, *b*)
Kings Ruin (Spicer, 1936, p. 55)

The late appearance and distinctive shape of Awatovi pestles make a derivation from the south improbable. However, since other southern traits indicate contact between the Jeddito district and the Hohokam area, it is possible that the idea of a bell-shaped pestle came from the south and was further elaborated at Awatovi.

Gebhard has reviewed the distribution of the "Simple Potato Masher Pestle."[26] As he defines it, it is somewhat shorter and more conical than at Awatovi, and less distinctly shouldered. He found them characteristic only of the eastern United States, and in relatively early horizons. The great gap in time and space makes a connection with Arizona very unlikely, and rather serves to emphasize the uniqueness of the Jeddito pestles.

Because of the uncertainty as to how these pestles were used, the detailed descriptions of Hopi ritual equipment by Voth, Stephen and Fewkes were examined. No objects like these pestles appear in any of their accounts, which are probably a good sample of Hopi rituals, although not including anywhere near all the important ceremonies.

POLISHING PEBBLES

FIGURE 40, *h*, *i*, *l–o*.

Description. Small, water-worn pebbles which show one or more nearly flat surfaces worn artificially, either finely striated or polished. The use has not been sufficient to greatly modify the shape of the pebble, but a few show a polished facet with fairly well marked edges. On others the polished surface is merely part of a naturally flat portion of the pebble. About one-quarter of the pebbles have one or both ends roughened or scarred by use for pounding; this minority would have been classified as pebble pounders if they did not have polished surfaces in addition to the battered ends.

Microscopic examination confirmed the impression from careful observation with the unaided eye—the polished surface is the result of a back and forth rubbing motion approximately perpendicular to the long axis of the surface. Microscopic striations on the polished surfaces are similar to the coarser striations on some of the less polished surfaces.

Size. Length, mean 4.2 centimeters, ranging from 2 to 7 centimeters.

Material. Nearly all are of quartzite, with a variety of colors and textures. A very few are of chert and basalt.

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[26] Gebhard, 1946, p. 205. Pestles of this shape are illustrated in Webb and DeJarnette, 1942, pl. 257 (2) and 290 (2).

Provenience.	Site 264, BM III-early P I	5
	Site 4A, Unassigned	1
	Site 169, P II	1
	Pink Arrow, P III-IV	2
	Awatovi, P III (W-O)	1
	” P IV (O-Y)	4
	” P IV (B/Y)	16
	” P IV (Y-17)	18
	” P V (17c)	36
	” Unassigned	2
	Kawaika-a, P III-IV	1
	Total	87

Although at Site 264 there were only five Polishing Pebbles, it is of interest that this is nearly twice as many, in proportion to the total number of stone artifacts, than in any subsequent site or period until the Pueblo IV horizon of Awatovi, when they are again relatively abundant.

Use and Distribution. The use of small pebbles in smoothing and polishing pottery is described by a number of observers.[27] However, as with many of the unspectacular artifacts, archæological descriptions rarely include any observation which would indicate the precise manner of use in prehistoric times. Pebbles for polishing pottery may or may not have well developed facets, but minute parallel striations will always be present to indicate that they were used for smoothing and polishing. From the meagre data available, the majority of polishing pebbles seem to be only slightly faceted, or not at all.

Such pebbles seem to occur in nearly all parts of the Southwest. They are apparently missing at some sites where polished pottery was found, but this is probably only a reflection of the scant attention paid to stone in many reports. However, their place might have been taken by hardwood polishers.

The finding of "polishing pebbles" where the pottery does not appear to have been polished with any such tool is a reminder that these pebbles could have served other purposes. They are known to have been used for grinding pigments,[28] for smoothing and polishing cooking slabs,[29] and on altars or in "medicines" for symbolic purposes.[30]

UNUSED PEBBLES

Description. Re-examination of the pebbles listed as polishing pebbles in the field catalogue disclosed that a majority of them showed no convincing evidence of ever having been used. In size, shape and material they are identical with polishing pebbles, but lack both facets and the minute striations that even a slight use would develop. They may have been picked up by Indians because of unusual or attractive colors, because of their natural polish, or symmetrical shapes, just as such pebbles are picked up today.

Provenience.	Site 264, BM III-early P I	6
	Site 4A, P I-II	2
	Site 111, P II	3
	Site 169, P II	1
	Site 105, P II-III	1
	Site 106, P III	1
	Pink Arrow, P III-IV	5
	Awatovi, P III (B/W)	4
	” P III (B/O)	1
	” P IV (O-Y)	7
	” P IV (B/Y)	46
	” P IV (Y-17)	36
	” P V (17c)	88
	” Unassigned	4
	Kawaika-a, P III-IV	1
	Total	206

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[27] Hough, 1918, p. 273. Guthe, 1925, pp. 60–64, pl. 21, *b*, *c*, *j*.

[28] Stevenson collection from Zuñi, U. S. National Museum.

[29] J. Stevenson, 1884, pp. 525–527.

[30] Dorsey and Voth, 1901, p. 22. Parsons, 1939, p. 716.

FLAT ABRADERS

TERMINOLOGY

AN ENTIRELY satisfactory term for this class of artifacts has not yet been found. They have been called whetstones, rasping stones and scouring stones by various archæologists. Alike chiefly in being made of abrasive material, they are worn into a variety of shapes resulting from the different objects on which they were used. Some have slightly concave surfaces, but the adjective "flat" is used, to distinguish them from abraders that are actually grooved. Some of the larger ones resemble what are called grinding slabs here, but it was found that a length limit of about 10 centimeters satisfactorily separated small stones which could have been used in the hand for shaping and smoothing from the larger stones which appear to have been used as slabs on which to grind pigment or other materials. Objects of this sort are sometimes referred to as palettes, from the supposition that pigments were ground on them. This is but one of many possible uses, so it seems inappropriate as a name for them all. To avoid the misleading implications of such specific terms as palette and whetstone, I have used the more non-committal term Flat Abrader. For descriptive clarity they have been divided into groups on the basis of shape: tabular, bar-shaped and irregular.

TABULAR FLAT ABRADER

Figure 21, *k–o*.

Description. Tabular pieces of stone, both faces flat or slightly concave. Shapes: rectangular (17), hexagonal (1), triangular or trapezoidal (4), round or oval (8) and irregular, with edges unground or only partly shaped (25). Presumably held in the fingers and rubbed against objects that were to be shaped or abraded. None have pigment stains on them, although the slight depressions on some of the flat surfaces are like those on the larger grinding slabs, which were used for paint grinding.

Size. Length 5 to 10 centimeters, width slightly less. Abraders longer than 10 centimeters were classified as grinding slabs, as already explained. Thickness 0.7 to 2.5 centimeters.

Material. Fine-grained sandstone of uniform texture, rather poorly cemented, of a variety of colors. This is an excellent abrasive, as the individual particles are, of course, quartz.

Provenience.	Site 263,	P I-II	1
	Site 107,	P I-III	1
	Site 102,	P II	1
	Site 105,	P II-III	1
	Pink Arrow,	P III-IV	3
	Awatovi,	P III (B/W)	3
	"	P III (W-O)	1
	"	P III (B/O)	2
	"	P IV (O-Y)	2
	"	P IV (B/Y)	9
	"	P IV (Y-17)	12
	"	P V (17c)	16
	"	Unassigned	1
	Kawaika-a,	P III-IV	2
	Total		55

BAR-SHAPED FLAT ABRADERS

Figure 21, *p–r*.

Description. Elongated pieces of stone with round, oval or subrectangular cross-section. Many have a series of facets merging into a rounded surface. Others are worn mainly on two opposite faces.

Size. Length 4 to 12 centimeters. Thickness 2 to 5 centimeters.

Material. Fine-grained sandstone of uniform texture, similar to that used for tabular flat abraders.

Provenience.	Site 22, P II	1
	Site 111, P II	1
	Awatovi, P III (B/O)	1
	” P IV (O-Y)	1
	Awatovi, P IV (B/Y)	10
	” P IV (Y-17)	4
	” P V (17c)	2
	” Unassigned	2
	Total	22

IRREGULAR FLAT ABRADERS

Figure 21, *s–u.*

Description. Irregular pieces of stone, their shape the result of random wear on various surfaces. Some approximate wedges, cubes or cones, but show no evidence of intentional shaping. Each is worn on several surfaces, some of which are flat, others broadly concave but not grooved.

Size. Largest dimension 3 to 10 centimeters.

Material. Fine-grained sandstone of uniform texture, similar to that used for tabular flat abraders.

Provenience.	Site 107, P I-III	1
	Site 108, P II-III	1
	Pink Arrow, P III-IV	1
	Awatovi, P IV (O-Y)	1
	” P IV (B/Y)	3
	” P IV (Y-17)	9
	” P V (17c)	3
	” Unassigned	1
	Total	20

USE AND OCCURRENCE OF FLAT ABRADERS IN THE SOUTHWEST

The ways in which these small pieces of abrasive stone were probably used are suggested by a description of Hopi wood-working methods:

> Wood was worked in the main like stone, and some wooden objects like dolls were ground to shape on stone without the interposition of any tool. Short simple implements like weaving batons and digging sticks were ground in this way and with an abrading stone of convenient shape held in the hand all the mechanical requirements for sculpture in the round, the undercuts, chamfers, ridges, grooves, etc., were possessed by the Hopi wood-worker. It is observed also that the quality of workmanship in wood shown in the ancient specimens has not been advanced by the possession of iron tools in the modern epoch. It appears that iron tools have only served to increase the facility of getting the raw material and the speed of manufacture of the products. The absence of the wedge which generally precedes the saw or any other primitive tool in the useful procural of masses of wood with plane surface was a great drawback to Pueblo wood-working. Such wood sections of small size and of very fissile wood as the flower stalk of yucca and like plants were indeed made in some localities, but in small amount and probably by splitting with the flint knife. Usually such pieces were ground down on sandstone from larger masses of wood.[1]

Among the wooden objects found at Awatovi which might have been made in this fashion are Hopi prayersticks (“bahos”), crosses, tablets, and weaving battens.[2]

No doubt other materials besides wood were worked with these flat abraders. They would be equally suitable for use on some of the more carefully made stone objects, such as axes and hammers, tchamahias, carved animals and the shaftsmoothers. The scarcity of most of these stone implements in Basket Maker III and Pueblo I may account for the absence of flat abraders until Pueblo II in the Jeddito sites. Another function of these abraders is suggested by the finding in a Pueblo II site in the Kayenta area (RB 551)[3] of a fragment of sandstone whose concave surface fitted the curvature of a large olla, which may have been smoothed with it.

Flat abraders, as the term is used here, are not commonly reported from sites in the Southwest, but such unspectacular artifacts are frequently overlooked or ignored. At Pueblo

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[1] Hough, 1918, pp. 276–77.

[2] Montgomery, Smith and Brew, 1949, p. 98.

[3] Beals, Brainerd and Smith, 1945, p. 55.

Bonito they happen to have been reported, since 26 of them were found in a small room adjoining a kiva. They may well have been used in preparing ritual paraphernalia.[4] In two of the most carefully compiled reports on Southwestern archæology, on the La Plata District, and on Snaketown, there are good descriptions and illustrations of flat abraders. That they are not ubiquitous, however, is demonstrated by their absence at Pecos, where the artifacts are also reported with unusual thoroughness. In the Jeddito sites they first appear in Pueblo II and comprise 1 or 2 per cent of the total stone artifacts in each succeeding period.

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[4] Pepper, 1920, p. 86.

GROOVED ABRADERS AND SHAFTSMOOTHERS

TERMINOLOGY

THE various stones in which grooves have been worn have been divided into two main groups in this report. First, those with little or no intentional shaping have been called Simple Grooved Abraders. The grooves vary greatly in number, size and shape. Second, those of intentionally produced shapes have been called Shaftsmoothers. A variety of materials is included, but the grooves are all rounded in cross-section, and of a size and shape that could have accommodated a slender wooden shaft, either for abrasion or for heating and bending.

The term "straightener" is not used here. This follows the suggestion of Gebhard[1] who found that texture, shape or material did not afford a satisfactory basis for typological distinctions between "smoothers" and "straighteners," particularly when working with published but inadequate reports. Toulouse[2] separates "smoothers" and "straighteners" on the basis of material, considering them abrasive and non-abrasive, respectively. This terminology seems to rest on the assumption that the grooved objects of dense, non-abrasive materials must have been used in a different manner from the abrading tools. There are ethnographic accounts, to which reference will be made later, of grooved tools used for heating and bending arrowshafts. Rinaldo[3] makes the same distinction between "smoothers" (abrasive) and "straighteners" (non-abrasive). Although these terms are descriptive of functions the implements doubtless served, they are less satisfactory than shape as a basis of classification, for three reasons.

First, for any comparative work, data are not generally available in published reports on the exact nature of the materials. Vesicular basalt is highly abrasive, other basalts less abrasive, so the general term basalt is not always sufficient description. Data on shape are much more frequently available in published descriptions or the accompanying illustrations.

Second, the materials employed in certain shapes of implements vary considerably, so that a classification primarily by material makes it necessary to include in each category each of the several shapes. Furthermore, dividing abrasive from non-abrasive materials requires drawing an arbitrary line somewhere along the range of textures, between the two extremes.

Third, the term "straightener" has commonly been used to designate the perforated bone, antler or wood wrenches found in some Southwestern sites. Similar tools are in use today among some Indian tribes, for straightening arrowshafts. Hence, the term is entirely appropriate for these perforated tools and should not be used for any other artifacts.

In view of these objections, I have not made a distinction between putative smoothers and straighteners, but have called them all Shaftsmoothers. Our ignorance of the exact use of these tools makes it preferable to omit "arrow" from the name. In the section on Use, the evidence from modern Indian practice will be evaluated. Nearly all these implements were capable of *both* smoothing and straightening, and determination of which was actually done cannot always be made.

On the basis of shape and special features the shaftsmoothers have been subdivided into Elongated, Loafshaped, Ridged and Transversely Grooved. There are hardly any two specimens quite alike, so within some of the subgroups a great many descriptive minutiae are included. The significance of some of them is not apparent at the moment, but they are put on record in the expectation that future comparative and functional analyses may make profitable use of them.

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[1] Gebhard, 1946, p. 218.

[2] Toulouse, 1939.

[3] Rinaldo, 1941a, pp. 14 and 27.

SIMPLE GROOVED ABRADERS

Figure 20, *c–g*, Figure 21, *g–j*.

Definition. Irregular pieces of abrasive stone in which grooves have been worn.

Shape. Irregular fragments, unshaped except by occasional pecking and/or grinding of a surface.

Grooves. One or more have been worn in each implement, by use in shaping or smoothing small objects of wood and bone, and possibly of stone. Grooves are of three forms: (1) straight from end to end, about 1 centimeter wide, identical with those on shaftsmoothers, probably produced by long slender sticks; (2) concave from end to end, either round or V-shaped in cross-section, ranging from 0.3 to 2.0 centimeters wide and from 0.1 to 1.5 centimeters deep; and (3) broad grooves 2 to 3 centimeters wide, 1 to 2 centimeters deep, probably worn by the shaping of larger objects. Grooves of the last two types are worn in the surface of stones built into walls, in the slabs paving floors and benches, and in the bedrock at sites or along trails. Below the mesa rim, along one of the trails near Awatovi, a large sandstone boulder is covered with hundreds of short grooves, mostly V-shaped in cross-section.

Size. The smaller of these abraders are about 7 by 4 by 2 centimeters, a size that could conveniently be cupped in the palm of the hand. Larger ones are heavy enough to rest on the ground and stay in place without more than slight bracing with hand or foot. These large portable blocks are 25 to 40 centimeters across.

Material. Except for one of scoria, all are of sandstone, most of it rather coarse textured and poorly consolidated. Grooves would wear quickly in such material and as large quantities of suitable stone were available pieces would be selected and discarded frequently.

Provenience.

Site 264, BM III-early P I	14
Site 4A, BM III-early P I	1
Site 4A, P I-II	2
Site 4A, Unassigned	1
Site 263, P I-II	1
Site 104, P II-III	1
Site 108, P II-III	1
Pink Arrow, P III-IV	4
Awatovi, P III (B/W)	2
” P III (W-O)	4
” P III (B/O)	6
” P IV (O-Y)	9
” P IV (B/Y)	72
” P IV (Y-17)	28
” P V (17c)	19
” Unassigned	9
Kawaika-a, P III-IV	10
Total	184

All in rubbish fill except: Five at Site 264, in an oval floor-hole near the west wall of Room 16. They are of various textures, and may be the tool kit of a craftsman. One in Awatovi kiva (Test 14, Room 5, P IV, Y-17) in pot set into northwest corner of bench.

Use. Little needs to be said about the various uses to which grooved abraders could be put. Hough's excellent account of wood working technics, quoted in reference to flat abraders, is equally pertinent here. The following list is probably far from complete, but will suggest the variety of uses to which grooved abraders were probably put.

1) Smoothing arrowshafts or arrow foreshafts, and shaping their ends. This work was also done on shaftsmoothers, whose functions are discussed below.

2) Shaping and smoothing such small wooden objects as spindles and prayersticks. The latter, the Hopi "bahos," are short sticks painted and decorated with feathers, used by the Pueblo Indians as offerings. Representations of such objects in the kiva murals at Awatovi indicates that the practice has considerable antiquity. Dorsey and Voth speak of "the sandstones which were used in sharpening the points of the sticks for the bahos."[4] The same process is mentioned by Stephen: "About 10 A.M. they began to prepare prayersticks, first smoothing the peeled willow wand with a piece of sandstone."[5] On another occasion he wrote: "She proceeds to cut off other prayerstick lengths. . . . She borrows my knife to cut with, but she rubs down the point and smooths the blunt end by rubbing on a bit of sandstone."[6]

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[4] Dorsey and Voth, 1902, p. 226.

[5] Parsons, 1936b, p. 834.

[6] Parsons, 1936b, p. 881. Another similar statement occurs in Voth, 1903a, p. 31.

3) Making bone awls, needles, etc. Direct evidence of this use of grooved abraders was found at Unshagi, New Mexico, where there was "an association between an arrowshaft straightener and an awl. The point of the awl rested in the groove, while the handle and the straightener rested on a slope of the floor level."[7] The absurdity of the term "arrowshaft straightener" could hardly be made clearer. It is not specified whether the groove was rounded or V-shaped in cross-section, but the latter shape was probably produced by just this kind of use.

4) The modern practice of smoothing yarn on a sandstone block[8] may have originated in prehistoric times, when cotton was spun and woven in great abundance. This may, however, be an innovation made necessary by the distinctive quality of woolen fibres.

5) Preparing materials for basket making. "A polishing stone sometimes grooved may be used, though the rods may be smoothed by drawing them over sand rock in place on the mesas."[9]

6) Shaping beads which have been perforated and strung. This would require a long straight groove. Roberts has reported that for this purpose modern Zuñi craftsmen use grooved stones like one he found at the Village of the Great Kivas.[10]

7) Other wood working might be done with grooved abraders whenever the nature of the object required. "The bow was worked out from the rough wood and finished by attrition on sandstone and with gritty rubbing stones."[11]

When I was inquiring about the former uses of stone tools at Second Mesa in 1947, a middle aged Hopi informant told me that the grooved abraders in figure 21, *g* and *h* looked just like molds for casting metal. He said that when he was a child they made such stone molds and cast the tin melted down from tin cans into toy jewelry. However, none of the artifacts found at Awatovi are suitable for use as molds, even if the art of metal casting was learned by the Hopi as early as the 17th century, which is unlikely.

Distribution. The Simple Grooved Abrader, defined here as an irregular chunk of abrasive stone with one or more grooves, occurs throughout the 12 centuries for which we have an archæological record in the Jeddito district. Their absence at several sites is probably due merely to the small number of artifacts from these sites. However, there is a sharp decline in the relative abundance in the 17th century. The following figures show the number of simple grooved abraders as a percentage of the total number of stone artifacts in each of the chronological periods indicated:

Basket Maker III-early Pueblo I	3.9 per cent
Pueblo I-II	4.4 per cent
Pueblo II	none
Pueblo II-III	2.5 per cent
Pueblo III	2.7 per cent
Pueblo IV	4.5 per cent
Pueblo V	0.6 per cent

The great amount of digging in 17th century Awatovi precludes the possibility that the sample of stone artifacts was not sufficiently large to be comparable to the other periods. Either some other tool was used in their place for shaping small objects of bone and wood, or else fewer of these objects were made than in the preceding years. The former is the more likely, particularly since the introduction of metal tools in even small numbers might considerably alter wood working technics in a short time. Another factor of possible importance in accounting for the sudden decrease in grooved abraders is suggested by a statement by Dorsey and Voth.[12] They observed the making of prayersticks at Mishongnovi, to be used as offerings to the gods or spirits, and state that all the litter, *including the sandstone grooved abraders,* was cleaned up and dumped northeast of the village, where similar rubbish from previous occasions could be seen. It is quite possible that at Awatovi just after the arrival of Spanish priests in the early 17th century there was a rapid development of secrecy concerning all religious and ritual matters. The manufacture of prayersticks may have become sufficiently surreptitious to necessitate the secret disposal of all waste left over, in some less conspicuous place than the common refuse heaps in abandoned rooms. The suppression of overt ceremonial activities is known to have resulted in secrecy rather than discontinuance in the eastern Pueblos, and a parallel at Awatovi during the period of intensive missionary effort during the 17th century is not improbable. The openness of much Hopi ritual today is evidence of the ineffectiveness of current missionary efforts in contrast to the more permanent changes brought about in New Mexico by almost uninterrupted mission activity.

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[7] Reiter, 1938, p. 164.

[8] Underhill, 1944, p. 38.

[9] Hough, 1918, p. 267.

[10] Roberts, 1932, p. 143, pl. 56, *b*.

[11] Hough, 1918, p. 288.

[12] Dorsey and Voth, 1902, p. 226. A similar observation by Stephen at First Mesa occurs in Parsons, 1936b, p. 651.

Elsewhere in the Southwest grooved abraders are widely reported, but the incomplete nature of the published data is typified by this recent statement, in a supposedly serious and detailed final site report: "Several irregular grooved sandstone fragments were of course also found, suitable for sharpening the point of an awl, but as these were not uniform in nature or in distribution they have not been pictured or included here." Between ignoring the "typical" and omitting anything "not uniform" there is little left with which to make detailed comparative analyses.

The admirable preliminary survey by Toulouse[13] served as the starting point for my detailed investigation. Unfortunately, it is difficult to go much beyond his few very tentative conclusions. There are almost no grooved abraders in Hohokam sites[14] before Pueblo influence is found in the Gila basin in the form of the Salado culture. This influence is represented in such sites as Los Muertos where a few of the implements appear.[15] In the Pueblo area grooved abraders are rare in the San Juan and Chaco drainages but not entirely absent. There is a single specimen from Alkali Ridge of Pueblo II date,[16] and in all of Morris' investigations of the La Plata District none were found earlier than Pueblo III and then only rarely.[17] A Basket Maker III site near Williford, Colorado, produced one somewhat unusual grooved abrader, used on six sides,[18] and Basket Maker caves in Kane County, Utah, contained grooved abraders.[19] A similar scarcity prevails in Chaco Canyon sites, although a few grooved abraders come from Leyit Kin,[20] Pueblo Bonito[21] and Bc 51,[22] and a single one was found at Aztec.[23] The Kayenta area, too, has yielded but a single grooved abrader, at Site RB 568,[24] of Pueblo III date. At several sites in these northern portions of the Pueblo area grooves are found in building stones and in bed rock that probably served the same purpose as those in portable grooved abraders. These "stationary grooves" are found occasionally to the south and have persisted in use to the present in the Pueblo towns, but conveniently portable implements have largely supplanted them.

Sites other than those mentioned above at which grooved abraders occur suggest a Rio Grande-Mogollon Rim-Little Colorado distribution during Pueblo III and IV. The implements have been found at the following sites: various Pajarito Plateau sites, Poshuouinge (LA 632, same as "Posi"), Riana Ruin, Unshagi, Nanishagi, Village of the Great Kivas, Mogollon Village, Swarts Ruin, Kinishba (?), Kintiel, Winona, Ridge Ruin, Grand Falls (NA 1600, originally "Sunset Crater"), and Tuzigoot. There is not enough information to make it certain that grooved abraders were lacking before Pueblo III in this southern Pueblo region, and it is possible that, as in the Basket Maker III-Pueblo I Jeddito sites, they were about as plentiful as they were later. Since it is rare for any totals to be given in reporting stone implements, there is no way of determining just how common any trait was at a site or during a period, but the impression from available data is that grooved abraders are more common along this Little Colorado-Mogollon Rim-Rio Grande zone than either to the north or south of it.

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[13] Toulouse, 1939. His type Ib is called here a Simple Grooved Abrader.

[14] One reported at Snaketown from Sacaton Phase, Sayles, 1937, pl. XXXIX, f.

[15] Haury, 1945a, p. 139, pl. 60, *b*.

[16] Brew, 1946, p. 240, fig. 48, L.

[17] Morris, 1939, p. 129, pl. 135, b.

[18] Rinaldo, 1939, p. 388, fig. 103.

[19] Nusbaum, 1922, p. 126.

[20] Dutton, 1938, pl. VIII, *a*.

[21] Pepper, 1920.

[22] Toulouse, 1939, p. 81.

[23] Morris, 1919, p. 24.

[24] Beals, Brainerd and Smith, 1945, p. 79, fig. 16, *n*.

ELONGATED SHAFTSMOOTHERS

Figure 22, *s–w*.

Definition. Oval or rectangular pieces of stone with a single groove in approximately the center of the flat upper surface, parallel to the long axis.

Shape. Sides and ends are smoothed by grinding, producing an elongated oval (sometimes called the "nail-buffer" type) or a subrectangular shape. A few have squared ends. Under surface generally flat, but sometimes rounded from side to side, sometimes showing wear as though the shaftsmoother was made of a mano fragment.

Groove. Shallow, and rounded in cross-section. Depth uniform for entire length, generally 0.1 to 0.2 centimeter. (Five grooves worn to depth of 0.3 or 0.4 centimeter.) Mean groove width 0.8 centimeter, maximum 1.8 centimeter, minimum 0.3 centimeter. Deeper grooves are also wider, so all could have accommodated wooden shafts 1 centimeter or a little more in diameter.

Use in Pairs. Figure 22, *u* and *v* were found close together in fill at Kawaika-a, are almost identical in size and shape, and could be conveniently held together in the hand to use as a pair. No other pairs found, but flat upper surfaces would have permitted most of them to be used this way.

Size: Length, mean 8.3 centimeters, maximum 13 centimeters, minimum, 5 centimeters. Width is usually about half of length.

Material.	Sandstone, fine- to medium-grained	22
	Sandstone, coarse-grained	10
	Vesicular basalt	4
	Tuff (?), fine-grained	1
Provenience.	Site 188, P III	1
	Pink Arrow, P III-IV	3
	Awatovi, P III (B/O)	1
	" P IV (O-Y)	1
	" P IV (B/Y)	6
	" P IV (Y-17)	5
	" P V (17c)	11
	" Unassigned	5
	Kawaika-a, P III-IV	4
	Total	37

LOAF-SHAPED SHAFTSMOOTHERS

Figure 11, *a–d*. Figure 21, *a–f*.

Definition. Carefully shaped blocks each with a single groove running lengthways. Thick, generally loaf-shaped.

Shape. 24 have sloping sides, incurving so that upper surface is narrow and almost wholly occupied by groove (fig. 11, *a*). The shape suggests a loaf of bread. One specimen (fig. 11, *b*) has a single sloping side, the other vertical, giving an asymmetric cross-section. The others have vertical sides (fig. 11, *c*). Viewed from above, shape is subrectangular, except for three fragmentary specimens that were oval or nearly circular. Ends vertical or sloping slightly in at top, with the exception of one which has ends sloping sharply in at the bottom.

Groove. Uniform in depth for entire length, rounded in cross-section. Varying degrees of polish seem to depend on texture of material rather than difference in function. Grooves are faintly striated longitudinally. If used for abrasion, tools of denser materials would have needed the addition of sand, but for polishing they would have been excellent. Mean groove depth 0.5 centimeter, maximum 1.0 centimeter, minimum 0.2 centimeter. Mean groove width 1.1 centimeter, maximum 2.1 centimeters, minimum 0.8 centimeter.

Use in Pairs. Since the grooved surfaces are convex they could not conveniently have been held together in pairs.

Effects of Heat. Two nearly identical specimens (fig. 21, *b*) of fine-grained sandstone show effects of extreme heat. Both have groove that is convex from end to end, whereas all others are straight. This suggests that they may have been employed for heating and bending arrowshafts, in the manner described below under Use. Since fill from which they came included much ash and burned material, effects of heat may have been accidental.

Additional Grooves. On two fragments there is a very small groove or incision parallel and close to the main groove. This might have been for the shaping or polishing of pointed bone tools. Specimens are from Awatovi Pueblo IV (B/Y), and Pueblo V (17c) and are of sandy limestone and vesicular basalt. Figure 11, *d* and another similar specimen have part of a former groove preserved along the lower edge. The tool was split, probably accidentally, and a new groove carved.

Size.	Mean	Maximum	Minimum
Length	6.8 cm.	9 cm.	5 cm.
Width	4.5 cm.	8 cm.	3 cm.
Height	3.8 cm.	6 cm.	2 cm.

Material.	
Very fine-grained sandstone	14
Very fine-grained sandy limestone	4
Fine-grained gray tuff	1
Pumice (?)	1
Dense igneous rock	1
Unidentified vesicular igneous rock with calcite (?) inclusions	9
Unrecorded	1

Provenience. Awatovi,	P IV (B/Y)	5
"	P IV (Y-17)	4
"	P V (17c)	19
"	Unassigned	3
Total		31

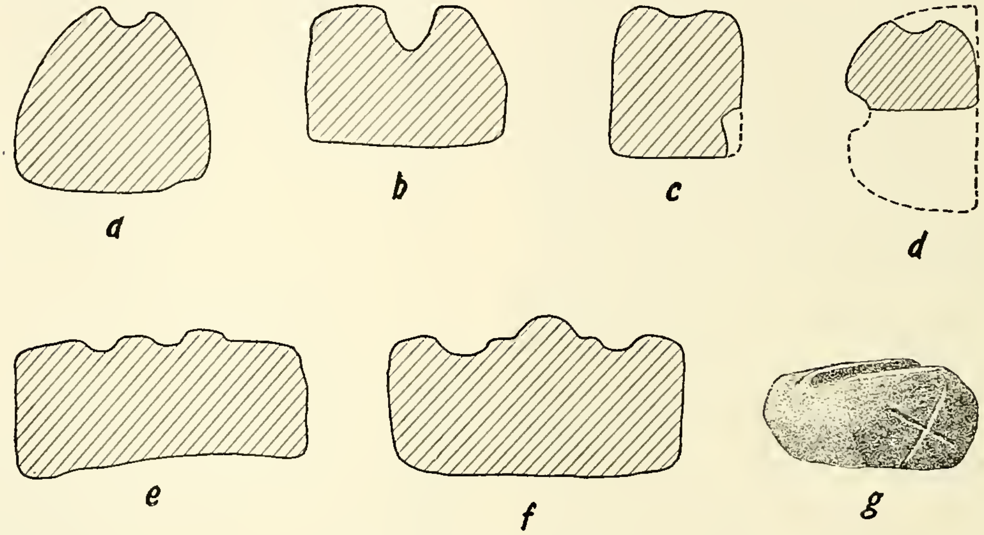

FIGURE 11. Shaftsmoothers.

a, Loaf-shaped shaftsmoother, typical cross-section, with sloping sides.
b–c, Loaf-shaped shaftsmoothers, atypical cross-section, with straight sides.
d, Loaf-shaped shaftsmoother, broken along groove, of which portion can be seen at lower left corner. Dotted line shows probable original shape. New groove has been made so that implement could be used again.
e–f, Ridged shaftsmoothers, ridge parallel to groove, cross-sections.
g, Ridged shaftsmoother, with incised "X" on one side.

	Provenience			Catalogue Numbers
a,	Awatovi,	Test 64, 0–100	Pueblo IV	39–97–10/19771
b,	"	Room 760, 0–50	Pueblo V	38–120–10/17549
c,	"	Surface	Unassigned	37–111–10/11715
d,	"	Room 428, 100–150	Pueblo V	37–111–10/11682
e,	"	Surface	Unassigned	38–120–10/11700A
f,	"	Room 514, 50–100	Pueblo V	37–111–10/11686
g,	"	Room 616, 80–125	Pueblo V	39–97–10/19762

RIDGED SHAFTSMOOTHERS

Figure 11, *e–g*. Figure 22, *a–h*.

Definition. Small blocks of stone, oval or rectangular, with carefully made ridges parallel and/or perpendicular to the groove that has been worn in one surface of each.

Ridge Parallel to Groove (Total 13). By cutting away part of the upper surface, a ridge is left adjoining the groove. Ridges are not notched. Shape of block subrectangular or oval, usually carelessly finished. Ridge carefully rounded and smoothed by grinding and rubbing. Ridges are 0.4 to 1.2 centimeters wide, and 0.1 to 0.9 centimeter high.

Figure 22, *a* has a second incompleted groove to right of ridge. Implement damaged by use as a pecking stone.

Figure 22, *b*, of basalt, worn smooth by much handling, and groove highly polished. Slight ridge made by roughly scraping away part of surface at right side of grooved face.

Figure 22, *c* has low ridge made by cutting away one side of flat upper surface.

Figure 22, *d* is carefully squared and smoothed fragment, with ridge 1.0 centimeter to the right of the groove.

Figure 22, *e* has groove off center, with adjoining ridge approximately on center line.

Figure 11, *e* has two parallel grooves, somewhat square in cross-section, perhaps carved out but not yet used. Surface cut away to leave ridge adjoining one groove.

Figure 11, *f* has two parallel grooves, the ridge between them higher than rest of surface.

Figure 11, *g* has groove with square cross-section, bordered by very narrow ridge. Ends of block bevelled on lower edge. Incised "X" on one side of block.

Ridge Perpendicular to Groove (Total 4). Although all four specimens are fragmentary, a T-shaped ridge can be discerned on each (somewhat uncertain on specimen from Site 231).

Figure 22, *f* is an irregular limestone block with groove wider than usual. Ridge low and broad where parallel to groove, and stem of T is more sharply defined.

Figure 22, *g* is rounded rectangle of quartzite, split along groove. Low T-shaped ridge, carefully shaped and smoothed.

Figure 22, *h* is fragment of shaftsmoother made of light brown pottery clay, well fired, but not polished except in groove which has high gloss. Included with stone implements because of similarity to stone shaftsmoothers. Groove bordered by two ridges, of which at least one had extension at right angle.

Groove. Uniform depth throughout length. Width about 1 centimeter, depth 0.2 to 1.0 centimeter.

Size.	Mean	Maximum	Minimum
Length	7.0 cm.	9 cm.	6 cm.
Width	5.6 cm.	8 cm.	4 cm.
Thickness	3.6 cm.	6 cm.	2 cm.

Material.	Ridge Parallel to Groove	Ridge Perpendicular to Groove
Sandstone	5	—
Basalt	6	—
Limestone	2	2
Quartzite	—	1
Pottery clay, fired	—	1

Provenience.		
Site 231, P III		1[25]
Awatovi,	P IV (B/Y)	1
"	P IV (Y-17)	3
"	P V (17c)	11
"	Unassigned	1
Total		17

TRANSVERSELY GROOVED SHAFTSMOOTHERS

Figure 22, *j–p*.

Definition. Blocks of stone, usually tabular, with one or more grooves across them transverse to the long axis.

Shape. Round (4), square (3), rectangular (7) or irregular (8 including fragments of uncertain shape). Grooved surface flat, with two exceptions: Figure 22, *k* is rounded and figure

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[25] Found on surface, so later date possible.

22, *n* has surface sloping down from both sides of groove.

Grooves. Single (19), double (2) or triple (1, fig. 22, *j*). Grooves rounded in cross-section, straight from end to end. Width approximately 1 centimeter, depth 0.3 to 0.6 centimeter, smoothed or polished, sometimes striated. Grooves of figure 22, *j* are stained red.

Size.	Mean	Maximum	Minimum
Length	6.6 cm.	10 cm.	4 cm.
Width	5.3 cm.	8 cm.	3 cm.
Thickness	2.8 cm.	5 cm.	1 cm.

Material.		
	Fine-grained sandstone, indurated or calcareous	14
	Limestone	2
	Vesicular basalt	2
	Non-vesicular basalt	1
	Scoria	1
	Quartzite	2

At Site 108 half a broken limestone one hand mano was made into a shaftsmoother. The other half was also found at the site, unmodified since the break.

Provenience.			
	Site 108, P II-III		1
	Site 231, P III		2
	Pink Arrow, P III-IV		1
	Awatovi,	P III (B/O)	2
	”	P IV (O-Y)	1
	”	P IV (B/Y)	9
	”	P IV (Y-17)	1
	”	P V (17c)	1
	”	Unassigned	1
	Kawaika-a, P III-IV		3
	Total		22

MISCELLANEOUS SHAFTSMOOTHERS

Figure 22, *i, q, r, x, y.*

Description. Most of these are fragments too small to be safely assigned to the foregoing groups. A few are unique and merit brief descriptions.

Figure 22, *y* and two others not illustrated have narrow grooves with a V-shaped cross-section. It is uncertain whether these are incompleted shaftsmoothers, or were used for sharpening such small objects as bone awls and needles. In contrast to simple grooved abraders, which sometimes have very small grooves, these are carefully shaped blocks, not irregular scraps of stone. Two are of fine-grained sandstone and one of limestone. Provenience: Awatovi Pueblo IV (Y-17) and Pueblo V (17c).

Figure 22, *x* is an irregular piece of white sandstone with five shallow parallel grooves, from Pink Arrow.

Figure 22, *q* and *r* are highly polished pieces of unidentified igneous rock, each with a pair of deep, well-worn grooves. Provenience: Awatovi Pueblo V (17c).

Figure 22, *i* is a small fragment from Pink Arrow, of importance because of a perforation through it vertically. The hole is 1 centimeter from the highly polished groove, and tapers downward. Whether there was originally a ridge along the groove, as there is in shaftsmoothers from Pecos with holes in them, cannot be determined because of the fragmentary condition. Material, fine-grained sandstone.

Material. Sandstone, limestone, basalt and unidentified igneous rock.

Provenience.			
	Pink Arrow, P III-IV		3
	Awatovi,	P IV (B/Y)	5
	”	P IV (Y-17)	2
	”	P V (17c)	10
	”	Unassigned	4
	Kawaika-a, P III-IV		1
	Total		25

USE OF SHAFTSMOOTHERS

The question of the function of these implements is a thorny one. It is a reflection of the unfortunate separation of archæology and ethnology in the Southwest that few descriptions by archæologists include the data necessary to make comparisons with accounts of the methods used in modern arrow smoothing and straightening. To begin with, I doubt that the distinction commonly made by archæologists between “smoothers” of abrasive material and "straighteners" of non-abrasive material is significant, although two distinct processes are involved. As pointed out previously, when the terminology of grooved abraders was discussed, it is possible to use sand and water as the abrasive in a highly polished groove in rock of even the finest texture. The striations in the grooves of some of the Jeddito shaftsmoothers suggest that just this was done. Furthermore, grooved stones of abrasive materials may have served in the non-abrasive straightening process.

In searching for adequate information on modern arrow making technics I have gone considerably beyond the Pueblo area, to which most of the other comparative remarks in this report are confined. Consideration of technics used in the Great Basin and California, as well as the Southwest,[26] permit the identification of two basic processes, *smoothing* and *straightening*. These processes are often confused in the literature, mainly because of careless terminology, or a failure of archæologists and ethnologists to appreciate the significance of the technical details they report.

Abrasion was used to smooth arrowshafts of wood. For this purpose grooved stones were sometimes used in pairs, and were often of coarse, friable sandstone. This process was used in northern California (Modoc and others), by the Surprise Valley Paiute, Havasupai, Maricopa, Pima (?), Zuñi, Hopi (First and Second Mesas), Eastern and Western Navaho, Apache (Mescalero, Lipan, Llanero and Ollero Jicarilla) and the Santa Ana and San Ildefonso Pueblos. In some of these tribes the hardwood arrows were self-pointed and the tip could be sharpened on the same grooved stone.

Straightening, rather than smoothing, is necessary when arrowshafts are of reed or cane. Several ways of doing this are practiced. First, wood, bone or antler wrenches may be used, with perforations which make it possible to apply carefully controlled pressure at any point. These are reported for the Eastern and Western Navaho, Apache (Northern and Southern Tonto, San Carlos, Cibicue and Llanero), Southern Ute, First and Second Mesa Hopi, Zuñi, Santa Ana and San Ildefonso Pueblos, Papago, Surprise Valley Paiute, Southeastern Yavapai, and Havasupai. Second, a portion of the cane or reed shaft can be heated and slightly bent. When cool it will hold the new shape. In some tribes the shaft is heated by means of a grooved stone resembling the "shaftsmoothers" described from various Jeddito sites. This method is reported for the Owens Valley Paiute, Surprise Valley Paiute, Southeastern Yavapai, Havasupai, Maricopa and numerous southern California tribes. As far as published data permit any generalization, this technic was not characteristic of the Pueblo region. The bending of the heated shaft need not be done with a grooved stone, however, as shafts were also bent by hand or between the teeth. Both the heating and bending were sometimes accomplished without a grooved stone. A flat pebble or even a potsherd was used by the Eastern Navaho, Mescalero Apache and Maricopa. The shaft was heated directly over a fire or placed in the warm ashes by the Owens Valley Paiute, Havasupai and Maricopa.

It should be noted that several tribes used more than one method. Abrasion was not used on cane or reed arrows, as far as I can discover. But hardwood shafts were sometimes straightened by the same heating and flexing technics used for reed or cane. Hopi arrows were of both reed and wood, with a wooden foreshaft in both cases,[27] so both smoothing and straightening would be necessary at times. The modern Hopi use only a wrench for straightening and grooved stones are used only for abrading and smoothing. "Suitable wood was selected, the bark removed, and the wood straightened with a wrench made of mountain sheep horn. The wood was smoothed on sandstone and cut to a length measured from the arm-pit to the tip of the middle finger."[28]

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[26] Useful data on the following tribes were found in the sources indicated:
First Mesa Hopi (Gifford, 1940, pp. 31, 121)
Second Mesa Hopi (E. and P. Beaglehole, 1935, p. 19)
Zuñi (J. Stevenson, 1884, p. 527. Gifford, 1940, pp. 31, 121)
Pima (Russell, 1908, p. 111)
Maricopa (Spier, 1933, p. 134)
Havasupai (Spier, 1928, pp. 150–51)
Cocopa (Gifford, 1933, p. 274)
Yuma (Forde, 1931, pp. 171–72)
Southeastern Yavapai (Gifford, 1932, p. 224)
Owens Valley Paiute (Steward, 1933b, p. 260)
Surprise Valley Paiute (Kelly, 1932, pp. 139, 143)
Modoc, Yokuts, Chumash, Koso, Luiseño, Cohuilla, Mohave, Diegueño, Mono (Kroeber, 1925, pp. 332, 530, 560, 591, 650, 704, 818 and pl. 49)
Apache, various bands, Ute, Eastern and Western Navaho, Papago, Santa Ana Pueblo, San Ildefonso Pueblo (Gifford, 1940, pp. 31, 121)

[27] Whiting, 1939, p. 23.

These ethnographic data permit the following inferences concerning the probable use of the archæological specimens from Jeddito sites: (1) Shaftsmoothers (as defined here) were used for abrasion, and may also have been used for the heating and flexing technic, although this is not now used in the Pueblo area. (2) Implements of coarse stone, with either shallow or deep grooves would be most suitable for abrasion. Most of the elongated and transversely grooved shaftsmoothers were probably used for abrading. Although only one pair was identified, others could have been used in pairs quite conveniently. It may be noted that some of the implements used by Southern California tribes for heating and flexing of shafts are shaped like the transversely grooved shaftsmoothers reported here, but are of steatite. (3) Heating and flexing if done at all, were most probably done with some of the loaf-shaped and ridged shaftsmoothers, which include fewer abrasive materials and have deeper grooves. In the loaf-shaped group, two implements had grooves that were convex lengthways, which would facilitate bending the shaft, and were apparently damaged by being subject to heat (possibly accidental, as they were found with other burned material). The deeper grooves would aid in the transfer of heat to the shaft. Shallow grooves, such as many of the elongated and transversely grooved implements have, would be less efficient for heating. (4) The description of Southeastern Yavapai practice suggests a possible function for the ridges, which must have been carved with considerable effort. "When used the stone was heated and the arrow warmed in the groove and bent over the median ridge."[29] The distinctive Largo-Gallina shaftsmoothers, and some from the Gila basin, have a series of short grooves across the median ridge which would be very useful if the ridge were used in this fashion. (5) It is impossible to be sure that one group of implements was used only for heating and flexing and another only for abrasion. Many of them could have served both purposes effectively, and careful examination of the implement will not always afford a basis for assigning one or the other function to it. It may be significant that the implements that appear more generally suitable for heating and flexing—the loaf-shaped and ridged shaftsmoothers—were not used until Pueblo IV (with a single dubious Pueblo III occurrence). The other shapes were already in use in Pueblo III, but the transversely grooved form occurs hardly at all in Pueblo V. Therefore, a change in the preferred technic may have been taking place, with the cause possibly a shift from only wood to both wood and cane as the approved materials for arrowshafts.

HISTORY OF SHAFTSMOOTHERS IN THE SOUTHWEST

The elongated shaftsmoother (which includes the form sometimes called "the nail buffer type") is not confined to the Southwest, but is widely distributed outside it. Toulouse has mapped occurrences in 12 states, either modern or prehistoric.[30] He concludes that it first appears in New Mexico in Pueblo III, probably from the Plains where it dates back to Signal Butte I in Nebraska. Almost no elongated shaftsmoothers occur in Arizona, other than those reported here from Jeddito sites of Pueblo III and later. These, however, are less like the Plains "nail buffer" shape than the specimens from Pecos are.

Loaf-shaped shaftsmoothers were found in the Jeddito district only at Awatovi, and only in Pueblo IV and V. Similar shaftsmoothers have not been found elsewhere, as far as I know, although some of the decorated and ridged implements at Pecos approximate them in shape.[31] The Awatovi collections made by Fewkes and Hough both included loaf-shaped shaftsmoothers.[32] In the present collection they are the most numerous form of 17th century shaftsmoother (19 out of 52). Whether similar tools are used by the Hopi today is not known.

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[28] E. and P. Beaglehole, 1935, p. 19.

[29] Gifford, 1932, p. 224.

[30] Toulouse, 1939, pp. 82, 85.

[31] Kidder, 1932, fig. 52, *d–f*.

Ridged shaftsmoothers were found in Jeddito sites of Pueblo III (?), IV and V. As a group they are the least well finished of the Jeddito shaftsmoothers. They are less carefully shaped than the ridged specimens from New Mexico and the Gila basin, and lack the decoration found on the latter. At Pecos 60 per cent of the shaftsmoothers are ridged and a majority have a T-shaped ridge, with deep holes drilled alongside the grooves. A single perforated specimen came from the Jeddito sites, from Pink Arrow (fig. 22, *i*). There are elaborate ridged shaftsmoothers at Pajarito Plateau sites, also. A possible source of this specialization is the Largo-Gallina Phase of northwest New Mexico, for which a date of 1100–1250 has been proposed.[33] The distinctive shaftsmoothers of this phase are "crested" with short grooves across a large longitudinal ridge and long grooves both sides of it.[34] Another area of elaborately ridged shaftsmoothers is the Gila-Salt valley, where they are an introduction from Pueblo IV to the north.[35] A few ridged and ornamented shaftsmoothers from Little Colorado and Mogollon Rim Pueblo sites probably reflect the southward spread of this trait.[36] Comparable to the Awatovi ridged specimens in simplicity are those from Winona and Ridge Ruin,[37] Bc 51,[38] and Unshagi.[39] Outside the Southwest proper are ridged shaftsmoothers from Southern California, attributed to the Serrano and possibly Cahuilla.[40] There is a distinctive form from the Bravo Valley Aspect of the Texas Big Bend area, which instead of a ridge has a knob at one side of the stone.[41] While all these local variations could stem from a single source of specialization, such as the Largo-Gallina of New Mexico, they lack detailed similarities and are more likely to be relatively recent local specializations of a widely distributed implement.

Transversely grooved shaftsmoothers appear in the Jeddito district in Pueblo II and III, and although they persist to the 17th century, are not common after Pueblo III (Awatovi B/Y period). This group is the most variable in shape of any of the shaftsmoothers, and some are very crudely made. There are comparable specimens at Pecos, and across central Arizona west to Flagstaff. They also appear in Pueblo IV sites of the Gila-Salt valley. Further north, there is only one reported specimen, of unknown age, at Waterfall Ruin in extreme northeastern Arizona.[42] In general their distribution is approximately the same as that of the ridged form.

To sum up this discussion of shaftsmoothers, it can be concluded that they are typical of only the southern part of the Pueblo region, and are common only after Pueblo II. The most elaborately made shapes occur in the Pecos-Rio Grande sites. The "nail buffer" form of the Plains was introduced in Pueblo III and never became common west of New Mexico, although the Jeddito elongated form may derive from it. In the Hohokam region shaftsmoothers were among the Pueblo IV traits introduced from the north.

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[32] United States National Museum Collections, No. 156065 and No. 292346.

[33] Hall, 1944.

[34] Douglass, 1917, p. 19. Mera, 1938, p. 243, pl. 9 (2). Hibben, 1938, p. 136, pl. 9, fig. 4.

[35] Haury, 1945a, p. 139, pl. 60*a*, *c*, *d*. Fewkes, 1904, p. 183, fig. 112. Fewkes, 1912, p. 126, pl. 61.

[36] Kinishba (Baldwin, 1939, p. 318, pl. 16), Chevlon, a frog-shaped shaftsmoother (Fewkes, 1898a, p. 529), Forestdale (Hough, 1903, p. 295), Showlow (Haury, 1931b, p. 22, pl. 6, fig. 1, *d*).

[37] McGregor, 1941, p. 180, fig. 63, A.

[38] Toulouse, 1939, p. 81.

[39] Reiter, 1938, pp. 164–65.

[40] Campbell, 1931.

[41] Toulouse, 1939, p. 86.

[42] Guernsey, 1931, 108, pl. 28.

PALETTES, GRINDING SLABS AND MORTARS

RAISED-BORDER PALETTES

Figure 23, *a–f*. Figure 24, *j, k*.

Definition. Flat slabs of stone, one face worn smooth and somewhat concave and surrounded by a raised border. They are heavier and cruder than Hokokam palettes and lack decoration.

Shape. Varies from rectangular (6) and trapezoidal (4) to ovoid or subrectangular (10). Poorly finished, with edges pecked and partly ground but still uneven. Bottoms irregular.

Borders. Insofar as it is applicable the terminology adopted by Haury for Hohokam palettes[1] is used here. Borders are only slightly raised, and are sloping on the inner edge. The border follows the outer contour of the slab except for being slightly more rounded at the corners. The only exception to this is a small fragment, figure 23, *e*, with inner edge of the border curved on a smaller diameter than the outer. Width of border is 1.0 to 3.7 centimeters, sometimes wider at ends than sides. Height of border is 0.7 to 0.1 centimeter. Two palettes (fig. 23, *a* and another not shown, both from Awatovi, Pueblo IV) have a groove through the border at one corner, carefully smoothed and about 1 centimeter wide, perhaps for pouring.

Mixing Surface. This is the entire area inside the border, in Haury's terminology. Of the nine larger palettes six have had worn into the mixing surface a considerably smaller depression as in figure 23, *a*, *b*. It might have been worn entirely by the grinding of pigments, but one palette has this secondary depression pecked as though to intentionally deepen it. Depth varies from almost nothing to 4.0 centimeters. The smaller palettes have only a single concavity occupying the entire mixing surface, with maximum depth 2.5 centimeters. A palette of white sandstone from Site 231 appears unfinished. It was originally a mano but the surface has been carefully pecked away to leave a raised border about 0.2 centimeter high.

Pigment. There is red pigment remaining on the mixing surface of four, green on one. Reasons will be given below, in the discussion of Use, for the belief that the others were also used for preparing paint.

Size. There appear to be two size groups, of which only the larger have a secondary depression in the mixing surface. The nine in the larger group have these dimensions:

Size.	Mean	Maximum	Minimum
Length	32.1 cm.	42 cm.	18 cm.
Width	25.9 cm.	30 cm.	15 cm.
Thickness	4.7 cm.	6 cm.	3 cm.

Of the smaller group only one is whole (fig. 23, *c*). It is 14.4 by 14.1 by 4.5 centimeters. Fragments belonging to this smaller group have widths of 15, 12, 12, 10 and 8 centimeters.

Material.	Fine-grained sandstone, yellow to brown	18
	Medium-grained sandstone, white	1
	Quartzite	1
Provenience.	Site 231, P III	1
	Awatovi, P IV (Y-17)	2
	" P V (17c)	15
	" Unassigned	2
	Total	20

All are from rubbish fill except one:

Awatovi Pueblo V, palette similar to figure 24, *k* found lying on floor of porch of main Church (Room 434).

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[1] Haury, 1937b, p. 121.

GRINDING SLABS

FIGURE 23, *g–j*.

Terminology. During the course of the field work there was a tendency to use this as a residual category. It was decided not to use the term "basin metate," for reasons already explained (see Metates), so a number of artifacts that had been so classified became "grinding slabs" instead. Between the shallowest mortars and the grinding slabs with the greatest wear it was difficult to make a satisfactory distinction, until it was decided to include in the latter category any slabs on which the concavity appeared to be entirely the result of use with no intentional excavation. Figure 23, *i* is a grinding slab which closely approaches the appearance of the shallower mortars. The larger tabular flat abraders (such as fig. 21, *k*) resemble the smaller grinding slabs (such as fig. 23, *h*), and a separation on the basis of size was found to be the most satisfactory. None of the abraders has pigment on the surface and none is more than slightly concave, whereas pigment occurs on grinding slabs as small as 12 centimeters long and some of the smallest grinding slabs are distinctly concave. As eventually defined, the category is quite satisfactory, since it includes slabs which appear to have been closely similar in function, and exhibit very similar grinding surfaces in spite of their great range in size and variety of shapes.

Definition. A flat slab, generally irregular in shape, with one or both faces worn smooth and slightly concave as a result of grinding or rubbing. It is believed that they were frequently used for paint grinding, but they could have served many other purposes equally well.

Shape. Most are irregular but with corners and edges somewhat smoothed by pecking and grinding. A few are approximately oval or rectangular (fig. 23, *g*).

Grinding Surface. Concave (about three-quarters of the specimens) or flat. Both faces of 16 have been used for grinding, only one face of the rest. None appear intentionally hollowed out, thus distinguishing them from raised-border palettes and from mortars. Metate fragments were used in making six. In the edge of one are two grooves, worn by sharpening or smoothing some small object, like the grooves in simple grooved abraders.

Pigment. Grinding surfaces of seven have red pigment, three have blue-green. Of these, four were found with other paint grinding equipment, making it almost certain that this was their function.

1) Slab on floor of Awatovi Room 465, Baptistry of main church, with several sherds which contained red and black pigments. Nearby was blue painted gourd rattle. Slab is 42 by 32 by 4 centimeters, with both faces concave. Material, fine-grained sandstone. Concavities are 18 by 14 centimeters, 2.8 centimeters deep, and 18 by 14 centimeters, 0.3 centimeters deep, one covered with red pigment, the other blackened with soot.

2) On floor of Awatovi Room 753 (Pueblo V), grinding slab of fine-grained sandstone 29 by 26 by 6 centimeters, with a paint grinding stone (fig. 19, *g*) and several fragments of malachite, making a complete outfit. Slab approximately square, three sides smoothed, fourth broken irregularly, concavity of grinding surface very slight.

3) Awatovi Test 33, Room 4 (Pueblo IV, Y-17) had figure 23, *j* on floor, with pebble nearby which might have been used on it as grinder. Slab is 43 by 34 by 2 centimeters, of fine-grained sandstone, with broad shallow depression stained blue-green.

4) Kawaika-a Test 5, Room 2 had slab and paint grinding stone in fill at 50–100 centimeter level (floor at 180 centimeters). Found together, both stained with green pigment. Slab is fine-grained compact sandstone, approximately triangular, 28 by 20 by 6 centimeters, with concavity 10 by 8 centimeters, 0.5 centimeter deep.

The smallest slab with pigment on it was 12 centimeters long. All those lacking pigment would have been as suitable for paint preparation as were those still stained.

Size. A minimum length of 10 centimeters was set, slabs smaller than that being classified as tabular flat abraders. Range and frequency of size as follows:

Greatest dimension 10.0 to 19.9 cm. 36

Greatest dimension 20.0 to 29.9 cm.	28
Greatest dimension 30.0 to 39.9 cm.	7
Greatest dimension 40.0 to 43.0 cm.	8
Greatest dimension unknown (fragments)	10

Material:	Fine-grained compact sandstone	60
	Medium- or coarse-grained sandstone	15
	Quartzite	4
	Unrecorded	10

Quartzite used at Site 264 (2) and Awatovi, Pueblo V (2).

Provenience.	Site 264, BM III-early P I	6
	Site 4A, BM III-early P I	2
	Site 263, P I-II	2
	Site 107, P I-III	4
	Site 104, P II	2
	Site 108, P II	1
	Site 111, P II	1
	Pink Arrow, P III-IV	5
	Awatovi, P III (W-O)	2
	" P III (B/O)	3
	" P IV (O-Y)	3
	" P IV (B/Y)	7
	" P IV (Y-17)	9
	" P V (17c)	35
	" Unassigned	5
	Kawaika-a, P III-IV	2
	Total	89

Besides the pigment-stained slabs already mentioned, one other grinding slab was found *in situ*:

Site 264, Room 16: a flat, irregular quartzite boulder, worn concave on both faces, found in a floor hole.

USE AND OCCURRENCE OF PALETTES AND GRINDING SLABS IN THE SOUTHWEST

For the purpose of grinding pigment and mixing it with a binder to make paint the Indians of the Southwest in prehistoric times used a variety of implements. For much of the work almost any flat slab could be used, preferably one with a texture fine enough not to absorb too much of the paint. Rinaldo calls these "lapstones" and describes them as "a type of object intermediate between the sandal stone and the paint palette on the one hand and the paint mortar on the other. In fact, these types grade into one another, all frequently showing evidences of pigment grinding. On the other hand, there are specimens of lapstone and sandal stone which do not show traces of pigment and may have been used as stones upon which to work."[2] They are considered by Rinaldo as typical of Anasazi sites of Pueblo III and IV.

A more specialized slab for mixing paints was typical of the Hohokam, beginning with the early Colonial Period and becoming most elaborate in the late Colonial and early Sedentary Periods.[3] In the Classic Hohokam such palettes virtually disappear, as shown by their rarity at Los Muertos.[4] The earliest Hohokam palettes are relatively simple, with raised borders first appearing in the Snaketown Phase, at the end of the Pioneer Period. The preceding phases are characterized by a simple rectangular slab on which it is assumed pigments were ground. This simple form, which is like the unspecialized slabs on which paint was ground in the Pueblo area, continue in use during later Hohokam phases, concurrently with the elaborately carved and decorated ones.

In the Pueblo area the most elaborate palettes are somewhat like those of the Hohokam Snaketown Phase, with a plain raised border surrounding the space on which the mixing was done. In order to furnish a basis for judging whether Pueblo palettes are derived from the Hohokam area, all known occurrences of palettes in the Pueblo area will be listed.

1) Kiatuthlanna,[5] in Pueblo I pithouse horizon, a small slab about 6 centimeters square with one face slightly concave, a groove around the edges and a small groove around each corner making them into knobs. This is a unique object, and although it is the first specialized paint grinding slab from the Pueblo area, it does not resemble any other palettes.

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[2] Rinaldo, 1941a, p. 105.

[3] Haury, 1937b, p. 124.

[4] Haury, 1945a, p. 140.

[5] Roberts, 1931, p. 157, pl. 35, *c*.

2) Whitewater Ruin,[6] early Pueblo III, another unique object, a large triangular slab, with a depression cut into it of trapezoidal shape with the smaller end rounded. Although the stone is quite porous its form and a slight reddish stain suggest that pigments were prepared on it.

3) Pecos,[7] two large slabs and several boulders or cobbles in which depressions have been pecked or ground. These are more like shallow mortars than like the Awatovi raised-border palettes, although they are approximately contemporary with them (Pueblo IV-V).

4) Kinishba, in the upper Salt River drainage. One of the few Hohokam traits in this predominantly Pueblo site was the slate palette.[8] It may be an actual import, since the Hohokam were still making palettes during the earliest occupation of this site.

5) Tuzigoot,[9] Verde Valley. Hohokam palettes, probably imported, although the main occupation of the site is so late as to make this possibly a local survival.

6) Turkey Hill Pueblo,[10] near Flagstaff. In commenting on the presence of typical Hohokam palettes in a 13th century Pueblo site, Haury says, "Turning to the diffusion . . . it found its way well into Pueblo territory, approximately as far as the three-quarter grooved axe. It is evident, therefore, that slate tablets survived later in the northern limits of their distribution than in the region from which they spread."[11]

7) Spur Ranch[12] near Luna, New Mexico, "an oblong dish, shallow and with a broad margin. It is almost identical with the tablets found along the Gila River."

8) Winona and Ridge Ruin,[13] near Flagstaff. One whole and two fragments of palettes, dating from the 11th or early 12th century. The fragments are regarded as Hohokam imports, and the whole palette, which is undecorated and somewhat like the Awatovi palettes, is possibly of local manufacture.

9) King's Ruin,[14] Verde Valley, probably 12th or 13th century, a fragment of a Hohokam palette.

10) Elden Pueblo[15] near Flagstaff, Pueblo III, "paint-grinding stones similar to those from Casa Grande."

Although a gap in both time and space remains between the Awatovi palettes and various northward extensions and continuations of Hohokam palettes, it is not impossible that there may be a connection between them. The Kiatuthlanna and Whitewater examples are unique, and not part of this possible development. The route of diffusion northward seems to be the Verde Valley, which is also one of the routes by which three-quarter grooved axes spread northward. Evidence is needed of some sort of palette in the Flagstaff area and also further north and east in Pueblo IV before the origin of the Awatovi palettes from this source can be considered certain. Such sites as Homolobi, Chevlon and Kintiel might be possibilities, and because of the presence of raised border palettes at Zuñi in the 19th century,[16] they might also be expected at Hawikuh.

The manner in which the Awatovi palettes were probably used is clearly explained by A. M. Stephen, in his observations at Walpi and other Hopi towns in the late 19th century. They were used in grinding various mineral and vegetable pigments and in mixing them with liquid to produce paint of the proper consistency and color for decorating carved wooden objects, dance costumes and the dancers' bodies. His most complete account is the following:

> After returning with the large bottle of water, Pauwa'tiwa produces a shallow oblong stone muller, about a foot long, and a rubbing stone about the size and something of the form of half a cricket ball. *Shakwa'mta*, the muller; *mata' kiadta*, the rubbing stone. . . . He produces a bag of shakwa' which is not blue but green carbonate of copper. He lays a small piece on the muller, beats it into small fragments with the rubbing stone and rubs it into a fine pulp. . . . He then pours about 2 gills of water on the pulp and rubs the pulp into a liquid. . . . He sponges up and presses

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[6] Roberts, 1940, p. 122, pl. 43.

[7] Kidder, 1932, pp. 72–74, pl. 48, 49, *a, b*.

[8] Baldwin, 1939, p. 318, and Cummings, 1940, p. 107.

[9] Caywood and Spicer, 1935, p. 85.

[10] Haury, 1932, p. 101.

[11] Haury, 1932, p. 105.

[12] Hough, 1914, pp. 31–32, fig. 52.

[13] McGregor, 1941, p. 176, fig. 60, A, 66, J, N.

[14] Spicer, 1936, p. 57.

[15] Fewkes, 1927, p. 213.

[16] J. Stevenson, 1883a, fig. 358.

> out the liquid into a small food basin . . . and rubs down with water one bit of ore after another. Occasionally, instead of using the feather sponge, he pours the liquid off the muller into the food basin.[17]

All this, incidentally, took place in a house, rather than a kiva, although the blue paint was made to use on masks. In describing a ceremony in a First Mesa kiva, Stephen wrote: "Supela brings in a flat pigment slab, 18 x 10 x 1½ inches, a rubbing stone, conical, 2½ inches across and 2¾ inches high . . . the pigment stone is much stained with green."[18] An illustration in an early report on Second Mesa appears to have a raised-border palette lying on the floor of a kiva, where prayersticks were about to be made.[19] Without doubt the paint grinding stones already described were used on both raised-border palettes and grinding slabs.

The similarity between the modern Hopi palettes and those found at Awatovi is also attested by the identification made by one of the Hopi workmen. He called the specimen "sakwamta" and this was later corroborated by a Hopi informant on Second Mesa, who briefly described its use. A palette of this same general shape now in the United States National Museum was collected by Stevenson in Arizona, and is presumably Hopi. He identified it in the museum catalogue as "Sacred Mortar, Sha-quam-ta." Exactly the same sort of palette was in use at Zuñi in the last century,[20] and may still be, although I do not know of its being reported recently.

The *grinding slabs* on which paint was ground are not all sufficiently concave to hold a liquid mixture such as Stephen described for the palettes. Dry pigments may have been prepared on them, as the finding of pieces of malachite with one at Awatovi would suggest. In the past, as at present, bowls and large sherds were also used for paint mixing. There was evidence at Awatovi that some of the mortars had held paint, a use to which they are known to have been put elsewhere. Besides paint preparation, grinding slabs may have served other purposes, since they are relatively unspecialized and are suited to the grinding or crushing of seeds, pottery clay, etc. But throughout the Southwest the most frequent use seems to have been paint grinding, as is evidenced by the following instances:

San Francisco Mountains Pueblo II sites (Bartlett, 1934, p. 22)
Sunset Crater sites (McGregor, 1936, p. 41)
King's Ruin (Spicer, 1936, p. 54)
Showlow (Haury, 1931b, p. 22)
Bear Ruin (Haury, 1940, p. 101, fig. 35, *a*, *b*)
Homolovi and Chevlon (Fewkes, 1904, p. 104)
Kintiel (Fewkes, 1904, p. 133)
Kawaika-a (Hough, 1903, p. 343)
Spruce Tree House (Fewkes, 1909, p. 41, pl. 21, *i*)
La Plata District (Norris, 1939, p. 131)
Aztec (Morris, 1919, p. 23)
Tseh So (Brand, Hawley and Hibben, 1937, p. 94, pl. 19, *d*)
Chaco Canyon Bc 51 (Woodbury, 1939, p. 62)
Pueblo Bonito (Pepper, 1920, pp. 58, 86, 92, fig. 18)
Wingate 11:53, 11:20, 11:24 (Gladwin, 1945, p. 73)
Village of the Great Kivas (Roberts, 1932, p. 142, pl. 54)
Whitewater Village (Roberts, 1940, p. 122)
Unshagi (Reiter, 1938, p. 164)
SU Site (Rinaldo, 1943, p. 192)

ROUGHLY-SHAPED MORTARS

FIGURE 24, *a–c*.

Definition. Thick slabs, irregular blocks or small boulders with a concavity pecked into one surface.

Shape. Exterior surface roughly pecked to convenient size, but still irregular. Flat bottomed. Concavities round or oval, some worn smooth by use have been roughened by pecking. About half have a wall 2 to 6 centimeters thick at the rim, with the concavity occupying most of the surface. In others wall is thicker and concavity is proportionately smaller, the smallest being one-third of outside diameter. One mortar was made by pecking a basin in the former grinding surface of a metate fragment.

Pigment. Three have red stains, probably from use in crushing pigment. Provenience: Awatovi, Pueblo IV (Y-17), 1; Pueblo V (17c) 2.

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[17] Parsons, 1936b, pp. 1192–93.

[18] Parsons, 1936b, p. 882.

[19] Dorsey and Voth, 1902, pl. CXIII, *a*.

[20] J. Stevenson, 1883a, fig. 358.

Size.	Mean	Maximum	Minimum
Outside length	22.2 cm.	44 cm.	9 cm.
Outside width	17.9 cm.	25 cm.	9 cm.
Outside height	10.0 cm.	17 cm.	5 cm.
Inside diameter	11.5 cm.	16 cm.	3 cm.
Inside depth	3.3 cm.	10 cm.	1 cm.

Material.		
	Compact quartzitic sandstone, fine to coarse	25
	Quartzite	5
	Unrecorded	2

Two mortars from Site 264 are of quartzite, one coarse sandstone.

Provenience.			
	Site 264,	BM III-early P I	3
	Awatovi,	P III (B/W)	1
	"	P III (B/O)	1
	"	P IV (B/Y)	4
	"	P IV (Y-17)	3
	"	P V (17c)	17
	"	Unassigned	2
	Kawaika-a,	P III-IV	1
	Total		32

All but three mortars came from rubbish fill:

Site 264, Room 34: two mortars on eastern bench of pithouse.

Awatovi, Pueblo V (17c): on floor of Room 419. This is one of paint-stained mortars.

BOWL-SHAPED MORTARS

Figure 24, *d–i*.

Definition. Exterior surface rounded, relatively thin walls, may have been used as containers as well as mortars.

Shape. Round, except for figure 24, *g, h, i,* which are subrectangular, oval and ovoid. Exteriors carefully rounded, maximum diameter just below rounded rims. Bottoms flat. Interiors relatively large, with walls from 3 to 7 centimeters thick at base, thinner at rim. Bottoms considerably thicker than walls, but one mortar worn completely through and many fragments seem to be from mortars worn so thin they broke. Figure 24, *h* may be unfinished.

Size.	Mean	Maximum	Minimum
Outside diameter	14 cm.	26 cm.	10 cm.
Outside height	8 cm.	13 cm.	4 cm.
Inside diameter	12 cm.	20 cm.	6 cm.
Inside depth	6 cm.	12 cm.	4 cm.

Material.		
	Sandstone, generally coarse	22
	Quartzite	8
	Basalt	3
	Tuff	1
	Unrecorded	5

At Site 264 only sandstone was used; at Site 263 quartzite.

Provenience.			
	Site 264,	BM III-early P I	3
	Site 263,	P I-II	1
	Awatovi,	P III (B/O)	1
	"	P IV (O-Y)	1
	"	P IV (B/Y)	1
	"	P IV (Y-17)	8
	"	P V (17c)	19
	"	Unassigned	5
	Total		39

BED ROCK MORTARS

At Awatovi, southeast of Test 52, there were several depressions ground or pecked into the bed rock sandstone (fig. 20, *a*). At least two had been worn by a circular motion and were like the interior of mortars. Others were shaped like the grinding surfaces of troughed metates, or were narrow grooves, probably used in shaping stone tools. Whether any were actually used as mortars is not known. Similar round depressions can be seen in the rock exposures around the Hopi towns today. Hough writes in connection with them, "One day some children were seen hammering diligently on the rocks with handstones, and it was found that they were digging cup-like cavities in the soft sandstone, perhaps making tiny play-reservoirs to catch rain water."[21] Similar bed rock mortars have been reported occasionally from several places in the Southwest, but within the Pueblo area never seem to have been of much importance.

OCCURRENCE AND USE OF MORTARS IN THE SOUTHWEST

Any attempt to determine when or where mortars were first used in the Southwest, or their subsequent spread, is rendered extremely difficult by problems of terminology. The terms "mortar" and "bowl" or "vessel" are used with such a variety of meanings by various archæologists that they finally have come to have almost no meaning. The terms impute function, but are generally used to distinguish objects differing in form. It seems to be commonly assumed, though seldom stated, that the cruder objects must have been mortars and that those more carefully shaped and finished must have been intended for containers. While names indicative of a reasonably plausible function are highly desirable, they must, if they are to have any value in conveying information, also refer to objects with a degree of similarity.

There have been several recent attempts to clear up the confusion that has crept into archæological terms for mortars and mortar-like implements. Gebhard[22] found that for the purpose of comparing stone artifacts on a continental scale it was practical to regard as vessels only those with thin walls, excellent finish and symmetry of shape, and no marks of pounding on the interior. On this basis, vessels are virtually absent in the Southwest outside of the area of the Hohokam culture. This distinction is similar to that used by Rinaldo,[23] who divides mortars into four groups: "Smooth Pebble," "Shallow Cup," "Rough Block," "Deep Cup." I believe that the last two would correspond pretty well to the categories used here, "roughly-shaped mortars" (which would also include some of the "Smooth Pebble") and "bowl-shaped mortars." Only figure 24, *b,* of all the Jeddito mortars might be assigned to the "Shallow-Cup" shape, small disks or rounded stones with a shallow concavity occupying one surface.

Attempting to classify the published data into these groups requires that many too brief references be disregarded. From the rest some tentative conclusions can be reached. First, mortars are of great antiquity in the Southwest and also occur commonly in large areas north and west into the Great Basin and California. It is quite likely that crude, shallow grinding slabs antedate the development of both mortars and metates. Some are fairly deep and would have been suitable for crushing and pounding. The gradual differentiation of metates and mortars probably resulted from the need for separate surfaces of different contours, the flatter being most satisfactory for grinding and the deeper more efficient for pounding.[24]

A second conclusion from the data currently available is that mortars of all types are relatively scarce in Pueblo culture, in comparison to the Mogollon and particularly the Hohokam. Although they occur from Basket Maker III onward in the San Juan drainage,[25] and scatteringly to the south through the plateau regions of Arizona and New Mexico, they seem to be more plentiful in the south. Speaking of the La Plata District, Morris observes, "Stone mortars and bowls were used to some extent during all periods but they were much more plentiful during Basket Maker III than at any other time."[26] In view of this, it is interesting that in the Jeddito district they are virtually absent after Basket Maker III-early

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[21] Hough, 1915, p. 121.

[22] Gebhard, 1946, p. 194.

[23] Rinaldo, 1941a, p. 65.

[24] Sayles, 1941. Sayles, 1945, p. 52. Rinaldo, 1943, p. 194. Haury, 1940, pp. 101, 104.

[25] Morris, 1939, p. 132, pl. 143. Fewkes, 1911a, p. 66. Rinaldo, 1939, p. 400, fig. 110. Morris, 1919, p. 28, fig. 16. Nordenskiold, 1893, p. 98, fig. 61, 62, pl. 38 no. 3, 4. Kidder and Guernsey, 1919, p. 124. Beals, Brainerd and Smith, 1945, p. 54. Brew, 1946, p. 240.

[26] Morris, 1939, p. 132.

Pueblo I (Site 264) until a few appear in Pueblo III and somewhat more in Pueblo IV. Possibly the trait would have died out completely if not reintroduced or reinforced from the south where mortars were common. At the important Hohokam site of Snaketown in several phases bowls and mortars are more plentiful than any other stone artifacts. Their elaboration there far surpasses anything achieved in Pueblo stone carving.[27] The scarcity of mortars in the eastern part of the Pueblo region should be mentioned. At Pecos there are stones with shallow pecked depressions, but they do not resemble mortars as much as they do grinding slabs (as defined herein) or very crude palettes.[28] There are a few mortars at other central New Mexico sites, Otowi, Tyuonyi, Unshagi, Poseuinge and Nanishagi.[29] Unless the paucity of published information on stone artifacts from Rio Grande sites is to blame, the trait does seem less common than further west.

Turning to the question of use, there is not much archæological information on which to base any inferences. What there is supports the evidence of an occasional comment by ethnographers working in the Pueblos. Here again, the confusion of mortars and bowls with grinding slabs and paint palettes makes the modern information hard to evaluate. Mortars of the cruder shapes were probably used in the preparation of both paint and food, and only the survival of the contents of a particular implement will indicate which purpose it served. Traces of pigment have been found in irregular mortars, in bowl-shaped mortars, and in what Rinaldo calls shallow cup mortars. Only the irregular mortars from Jeddito sites had paint stains in them. There is less evidence of the crushing of food, since organic remains have usually disappeared. The best-made stone mortar or vessel that has been found in the Four Corners region contained charred beans. It came from a Pueblo III kiva on Alkali Ridge.[30] The excellent workmanship and the two small lug handles would suggest use for more than ordinary purposes, but without the evidence of its contents classification as a vessel might be questionable.

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[27] Sayles, 1937, fig. 42, pl. LII-LXXIII.

[28] Kidder, 1932, p. 72, fig. 48, 49.

[29] Reiter, 1938, p. 163. Reiter, Mulloy and Blumenthal, 1940, p. 31. Jeançon, 1923, p. 22, pl. 19, 20. Exhibits at Museum of New Mexico, Santa Fe.

[30] Brew, 1946, p. 240, figs. 48, *g*, 175, *j*.

CHIPPED STONE IMPLEMENTS

GENERAL REMARKS

SCARCITY OF CHIPPED STONE

THERE was a surprising lack of chipped stone artifacts at all the Jeddito sites. Abundance in different chronological periods is indicated by the following totals:

	Shaped (blades, points, drills)	Unshaped (scrapers, blades, cores, etc.)
Basket-Maker III-Pueblo I	8	10
Pueblo I-II	8	3
Pueblo II	1	11
Pueblo II-III	3	3
Pueblo III	8	60
Pueblo IV	58	257
Pueblo V	118	250
Totals	204	594

Additional finds, mostly from surface of Awatovi, and lacking chronological assignment, 716.

Altogether, chipped implements comprise only 18 per cent of the stone artifacts found at Jeddito sites, and only 40 per cent of these chipped artifacts are intentionally shaped tools, the rest being flakes put to various uses, and a few cores.

A larger proportion of chipped points and blades is listed as coming from the surface of Awatovi ("Unassigned") than from any other provenience. It was the practice of several members of the staff to save all stone artifacts found on the surface during their activities at the site, and in the course of five seasons there was hardly a part of the entire site not carefully gone over this way. Small pieces of stone, like potsherds, tend to accumulate on the surface of rubbish deposits when the finer refuse, such as ash and organic matter, is removed by rain and wind. During the centuries since Awatovi was abandoned erosion has concentrated on the surface the artifacts from the most sloping or exposed deposits, and it is this concentration that is represented by the many specimens listed as "Awatovi Unassigned."

The lack of chipped stone artifacts in the earlier sites may be partly due to the ease with which such objects could be carried away by the inhabitants when a house was abandoned, in contrast to such implements as metates. Also, some of the early sites were of relatively brief occupation and little accumulated rubbish was found.

CLASSIFICATION

In spite of the paucity of chipped tools, an attempt at classification was made, independently of the various other systems in use by Southwestern archæologists. This attempt convinced me of the value of the system outlined by Kidder in "The Artifacts of Pecos" and later followed by Morris in reporting his work in the La Plata District. However, for arrangement of the descriptions and the distributional discussions, I have separated the shapes into three main groups; Stemless, Side Notched and Diagonal Notched. The terms arrow point, spear point, dart point, knife, etc., are avoided, and the rather non-committal terms *point* and *blade* are used. As functional terms they are not meant to be mutually exclusive, and since some artifacts are suitable for both cutting and piercing they can be used interchangeably. The evidence for specific uses of the various shapes of point and blade will be discussed after the descriptions.

NOMENCLATURE

Stem and *blade* are mutually exclusive terms, together comprising the whole of any chipped implement. The stem is the portion modified for hafting, and includes the part of the implement below the shoulders or notches. The stem has been referred to as the "tang" by some authors. Sometimes there is no stem, as in figures 25, *k–m* and 27, *a–c,* in which case the implement may be referred to as a blade. The blade of a stemmed point is the part from shoulder or notches to tip.

Base refers to the lower end, or butt; the part of the edge more or less perpendicular to the long axis.

Shoulder: an offset where a relatively narrow stem joins a broader blade. When sloping out and down, as in figure 27, *d*, it may be called a barb.

Notches are indentations in the edge of the point, almost always in pairs on opposite sides. They may also be the base, or in the "corner," that is, at the junction of side and base, as in figures 25, *r* and *x* and 27, *d*. Such notches are here referred to as *diagonal*.

Tip: the pointed end opposite the base.

Sides: the two edges from tip to base, or sometimes meeting to form a pointed base, as in figure 27, *j*.

SUMMARY OF SIGNIFICANT SHAPES OF CHIPPED STONE TOOLS

Before beginning the detailed descriptions of all the forms of chipped objects from the Jeddito sites, the few conclusions reached will be summarized.

1) Stemless blades or points: Mainly large leaf-shaped blades from Pueblo III, IV and V. Their absence in earlier Jeddito horizons is in contrast to their relative abundance in other sites of the same age elsewhere in the Pueblo area. There were none of the slender unnotched triangular points typical of the Hohokam culture.

2) Side Notched Points: this is the most abundant Jeddito type. At the earlier sites (Basket Maker III to Pueblo II) they are large and broad, in contrast to the shape most common from Pueblo III on. These are the "typical" Pueblo points found in such quantities in some collections. At Awatovi they are small, triangular and very carefully made, but usually with notched base in distinction to the characteristic straight base of the La Plata District and the slightly concave base found at Pecos. This notched base suggests a northern relationship, since the typical points of the modern Shoshoneans of the Great Basin are of this shape.[1]

3) Diagonal Notched Points: More common in the earlier horizons, but persisting into the 17th century.

4) Serrate Points: Not numerous, and limited to Pueblo III, IV and V, although elsewhere in the Southwest they occur much earlier than this. Possibly the inspiration for the Jeddito serrate points is the Hohokam area, where serration is a common technic.

5) Gun flints (?): Four rectangular pieces of chipped stone may be gun flints. If so, they are one of the few direct evidences in the stone material of the Spanish occupation of Awatovi.

6) Scrapers or knives were made of unshaped flakes, either with no retouch of the edge, or especially in the later periods with an edge of the flake retouched for greater sharpness.

7) Drills are rare, particularly at the earlier sites, but several distinct shapes were made.

STEMLESS BLADES

ASYMMETRIC STEMLESS BLADES

Figure 27, *c*, *m*, *n*.

Description. These blades are of four shapes: crescentic (3), triangular with square or convex base (6), lanceolate (3), and parallel edged with an oblique end (1). The crescentic blades are long (9 to 14 centimeters) and well made, with no twist or alternation to the retouch on the edges. The triangular blades are relatively thick, with more sinuous edges due to the coarseness of the flaking. They are 5 to 7 centimeters long, but two fragments may have been longer. The lanceolate blades, with both ends pointed, are thick like the triangular blades, with the same sinuous edges. The single oblique-ended specimen is fragmentary, one end being missing.

Size. Length, maximum 14.3 centimeters, minimum 6.0 centimeters. Width, maximum 4.9 centimeters, minimum 2.3 centimeters. Thickness greater than in most Jeddito chipped implements, with maximum of 1.7 centimeters.

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[1] Linguistically, of course, the Hopi are related to these Great Basin tribes, but they have few cultural similarities with them.

Material.		
	Chert	9
	Gray quartzite	2
	Slate	2

Provenience.		Crescentic	Triangular	Lanceolate	Oblique-ended	Total
Awatovi,	P III (B/W)	1	—	—	—	1
"	P IV (B/Y)	—	2	2	1	5
"	P IV (Y-17)	1	—	—	—	1
"	P V (17c)	1	2	1	—	4
"	Unassigned	—	2	—	—	2
	Total	3	6	3	1	13

SYMMETRIC STEMLESS BLADES, POINTED BASE

Figure 27, *j*.

Description. Finely chipped leaf shaped blades. Edges sharp with no sign of wear. The larger has a marked twist, due to the two edges being retouched on opposite faces.

Size. 11.5 by 3.7 by 0.6 centimeters, and 9.0 by 2.7 by 0.8 centimeters.

Material. Light brown chert.

Provenience.		
	Pink Arrow, P III-IV	1
	Awatovi, Unassigned	1
	Total	2

SYMMETRIC STEMLESS BLADES, ROUND BASE

Figure 27, *a*, *g*.

Description. Leaf shaped to triangular with single pointed end. Edges convex on the broader blades, almost straight on the narrower.

Size. Length, maximum 14.1 centimeters, minimum 3.2 centimeters.

Material.		
	Chert	17
	Gray quartzite	1
	Slate	1

The chert includes one blade of banded red translucent jasper.

Provenience.			
	Awatovi,	P IV (O-Y)	1
	"	P IV (B/Y)	3
	"	P IV (Y-17)	1
	Awatovi,	P V (17c)	8
	"	Unassigned	3
	Kawaika-a,	P III-IV	2
	Old Shungopovi,	P IV-V ?	1
	Total		19

Figure 27, *a* comes from the clean sand fill of the kiva (Room 788) under the main church at Awatovi, possibly placed there as an offering.

SYMMETRIC STEMLESS LARGE BLADES, STRAIGHT BASE

Figure 27, *b*, *f*.

Description. Leaf shaped to triangular, one end pointed, one end straight. Edges convex (4) or straight (8). Workmanship variable from good to poor.

Material. Chert.

Size. Two blades are large; 9 by 6 by 0.5 centimeters, (fig. 27, *b*) and 8 by 3 by 0.6 centimeters. The others are much smaller: length, maximum 5.0 centimeters, minimum 3.7 centimeters, width, maximum 4.2 centimeters, minimum 1.9 centimeters.

Provenience.			
	Awatovi,	P III (W-O)	1
	"	P IV (B/Y)	1
	"	P V (17c)	6
	"	Unassigned	4
	Total		12

SYMMETRIC STEMLESS SMALL BLADES, STRAIGHT BASE

Figure 25, *k–m*.

Description. Differ from preceding chiefly in size. Slender and triangular with edges straight (8) or convex (6). Bases straight except for three with concave bases. One blade broad and straight based, nearly an equilateral triangle.

Material.	Chert	13
	Obsidian	2

Chert includes a mottled and banded red agate. Obsidian is nearly opaque black.

Size. Length: maximum 3.5 centimeters, minimum 1.8 centimeters. Width: maximum 1.5 centimeters (except for equilateral blade 2.2 centimeters wide), minimum 1.0 centimeters.

Provenience.	Site 4A,	P I-II	2
	Site 4A,	Unassigned	1
	Awatovi,	P IV (B/Y)	1
	”	P V (17c)	2
	”	Unassigned	9
	Total		15

LARGE FRAGMENTS, PROBABLY STEMLESS

All are tips with bases missing, and probably come from large stemless blades like those described above, since they are larger than most of the notched blades. Edges are straight (13) or slightly convex (22).

Provenience.	Pink Arrow,	P III-IV	2
	Awatovi,	P III (B/W)	1
	”	P IV (B/Y)	5
	”	P IV (Y-17)	5
	”	P V (17c)	11
	”	Unassigned	8
	Kawaika-a,	P III-IV	2
	Chakpahu,	P III-IV	1
	Total		35

OCCURRENCE OF STEMLESS BLADES IN THE PUEBLO AREA

With three exceptions stemless blades were found in Jeddito sites of only Pueblo III, IV and V. The exceptions are small triangular slender points from Site 4A (Pueblo I-II). The majority of stemless blades at Awatovi are relatively large and are symmetrical. That such blades should be absent in the earlier horizons is quite surprising, as leaf-shaped blades with either round or square base occur widely in the Southwest in sites of Basket Maker III to Pueblo III and contemporary sites of Mogollon affiliation. The following list is probably not complete, but illustrates this point:

Rosa Phase
Bear Ruin
SU Site
Shabikeschee
Kiatuthlanna
Whitewater Village
Williford Sites
Alkali Ridge
Segi Cave No. 1
Rainbow Bridge 551, 568 and 1006
La Plata sites (Basket Maker III through
 Pueblo III ?)
Betatakin
Cohonino Focus
Tuzigoot
Whitemound
Tseh So

Rinaldo says of these leaf-shaped blades: "This type of knife came into use in Modified Basket Maker times and continued in use as the most popular form of blade up to the time of its replacement by iron and steel knives from Europe."[2] These blades are almost entirely absent in the Hohokam culture, but in the Mogollon and Pueblo cultures are generally regarded as so common as to have little diagnostic value, either areally or temporally. There is no apparent explanation for their absence from the Jeddito sites, until Pueblo III times, and their rarity even later.

The slender, unnotched points that are characteristic of the Hohokam culture (where they are frequently serrate)[3] are called "Cohonino Points" by Colton[4] because of their abundance in a culture complex to which he has given that name. Although they are absent in the Jeddito district, Rinaldo[5] has noted their presence in the Pueblo area as a result of trade or imitation. Similarities to the Hohokam are closest at the following sites: Tseh So, Aztec, Pecos, Unshagi, Kinishba, Marsh Pass Ruin A and Pueblo II sites of the San Francisco Mountains. Although other probable Hohokam imports or imitations occur in the Jeddito sites, this particular shape of chipped point does not.

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[2] Rinaldo, 1941a, p. 31.

[3] Sayles, 1937.

[4] Colton, 1939, fig. 3, *j*, and 1946, p. 290, fig. 167, C.

[5] Rinaldo, 1941a, p. 23.

SIDE NOTCHED POINTS: STEM WIDER THAN SHOULDER

STRAIGHT BASED SIDE NOTCHED POINTS

Figures 25, *b*, *q*, and 26, *j*, *o*.

Description. Triangular points with expanding stems wider than the shoulders. The long edges are straight, the bases straight. Notches are small, approximately perpendicular to the long axis, close to the base and vary from shallow to a depth nearly as great as the width.

Size.	Length 3.0 cm. or more (maximum 3.6 cm.)	7
	Length less than 3.0 cm. (minimum 1.4 cm.)	9
Material.	Obsidian	5
	Chert	11
Provenience.	Awatovi, P III (B/W)	1
	" P V (17c)	4
	" Unassigned	10
	Kawaika-a, P III-IV	1
	Total	16

Figure 25, *q* was with a burial (No. 89) just east of the entrance to the main church, of 17th century date. It was on the left arm of the skeleton and is the longest of the group (3.6 by 1.2 by 0.4 centimeters). The only other artifact with the burial was a bowl.

CONCAVE BASED SIDE NOTCHED POINTS

Figure 25, *i*.

Description. Triangular with straight (8) or slightly convex (4) sides. Base shallowly concave for entire width. Notches small, perpendicular to long axis, similar to those of preceding group. Except for concave base these points are indistinguishable from preceding group.

Size. One fragment (from Kawaika-a) is 3.0 centimeters long and 1.7 centimeters wide. The others are smaller, length from 1.3 to 2.2 centimeters, width from 0.7 to 1.4 centimeters. Points of this size could hardly be used except as arrowheads, and they are one of the few groups which showed no evidence of any other use, since they were without wear from cutting or scraping.

Material.	Obsidian	3
	Chert	9
Provenience.	Awatovi, P V (17c)	2
	" Unassigned	8
	Kawaika-a, P III-IV	1
	Chakpahu, P III-IV	1
	Total	12

NOTCHED BASED SIDE NOTCHED POINTS

Figures 25, *a*–g, and 26, *m*.

Description. Triangular with long edges straight or nearly so and greatest width at base. Side notches are perpendicular to long axis, similar to two preceding groups. Base notches vary from shallow to a depth less than the length of the stem. The deeper base notches are in a minority (12 specimens) and are associated with relatively broad side notches so that only a slender flange is left between the notches, as in figure 25, *c*. One point (the longest of this group) has a second pair of notches higher up the sides toward the tip, perhaps for more secure hafting.

Size.	Length 3.0 cm. or more (maximum 4.3 cm.)	4
	Length less than 3.0 cm. (minimum 1.6 cm.)	43

Most are between 1.8 and 2.3 centimeters, and like the preceding group, were undoubtedly used as arrowheads. They showed no evidence of use for cutting or scraping.

Material.	Obsidian	15
	Chert	32
Provenience.	Pink Arrow, P III-IV	1
	Awatovi, P IV (Y-17)	3
	" P V (17c)	15
	" Unassigned	27
	Kawaika-a, P III-IV	1
	Total	47

SIDE NOTCHED POINTS: STEM NARROWER THAN SHOULDER

WIDE BASED SIDE NOTCHED POINTS

Figures 25, *p, t, u, v;* 26, *p;* 27, *k.*

Description. Triangular or leaf-shaped blades, with edges straight (26) or slightly convex (10). Notches are much larger than in the preceding wide-stemmed groups, and have a maximum width of 0.8 centimeters, and maximum depth of 0.5 centimeters. The notches are so near the base that some of them are similar to those termed "diagonal," but are approximately perpendicular to the long axis. Bases are straight (12), convex (10) or concave (14). Workmanship varies from excellent to poor, with about half the blades marred by insufficiently controlled technic and resulting removal of large chips at inappropriate places.

Figure 25, *t*, of dark green hornstone (?), has been polished leaving only traces of the chipping by which it was initially shaped. Its edges are straight and smooth and the break at the base smoothed over. A slight groove at the inner portion of the notches indicates that a suspension cord was tied around it and so the smoothing is probably due to its being kept as an ornament or amulet.

Figure 25, *v* is irregular and crude in shape, but thin and skillfully chipped with large pressure flakes removed. It may originally have been 5 to 7 centimeters long, since the remaining parts of the sides converge very gradually.

Figure 25, *p* was probably about 4 centimeters long originally and is carefully made with a slightly different shaped stem from the others.

Figure 25, *u* is unevenly shaped with only one notch well defined. Length, 4.0 centimeters.

Size.	Length 5.0 cm. or more (maximum 5.6 cm.)	8
	Length 3.0 to 4.9 centimeters	22
	Length less than 3.0 cm. (minimum 2.6 cm.)	6
Material.	Obsidian	3
	Chert	33
Provenience.	Site 264, BM III-early P I	1
	Site 4A, BM III-early P I	1
	Site 4A, P I-II	1
	Site 4A, Unassigned	1
	Pink Arrow, P III-IV	2
	Awatovi, P IV (B/Y)	1
	" P IV (Y-17)	3
	" P V (17c)	13
	" Unassigned	11
	Kawaika-a, P III-IV	1
	Kokopnyama, P III-IV	1
	Total	36

Figure 26, *p* was with a burial (No. 97) in the Baptistry of the main church, of 17th century date, on the left knee of the skeleton. It is whole, 4.4 centimeters long. No other artifacts were with the burial. The only other point in this group that was not in rubbish fill or on the surface came from the floor of Awatovi, Room 734, Pueblo V (17c).

NARROW BASED SIDE NOTCHED POINTS

Figures 25, *o*, and 26, *g*.

Description. These blades are distinguished from the foregoing group mainly on the basis of their narrower bases. The notches are also shallower, with depth always less than breadth. Blades are more leaf-shaped than triangular, with slender stem. Workmanship is crude and shapes irregular. Edges of three are worn down very much, undoubtedly from use as knives or scrapers.

Size. Length 4.8 to 3.3 cm.
Width 2.0 to 1.3 cm.

Material. Chert

Provenience.	Awatovi, P V (17c)	3
	" Unassigned	2
	Total	5

OCCURRENCE OF SIDE NOTCHED POINTS IN THE PUEBLO AREA

The largest number of points from the Jeddito district are side notched (about a third of the total). The earliest sites yielded examples over 3.0 centimeters long, somewhat irregularly shaped with shoulders and base about the same width. Roberts found similar points, slightly larger, which he termed "spear points" at the Piedra Sites (Pueblo I and early II),[6] at the Kiatuthlanna pithouses (Pueblo I),[7] at Shabikeschee (Basket Maker III)[8] and Whitewater Village (Pueblo I-II).[9] In his earlier reports he suggests that "knives" are similar in size and shape but have the notch placed diagonally, but it is doubtful if this distinction is generally applicable, since the shape of the notch does not seem to determine whether the point is placed in a handle or on a projectile shaft. Knives with the wooden handles still intact have been found with both diagonal notches (White Dog Cave)[10] and with perpendicular side notches (Pueblo Bonito).[11] Even the form of notch used for atlatl points was not fully standardized, since a few have been found diagonally notched,[12] while the majority are side notched.[13]

Considering only the Jeddito district, it would seem that side notching of points started as early as Basket Maker III and was first used on the broad, relatively large points that were in vogue then. Later, when small points came into style, it was the common method for notching them, but continued in use on some larger points. Evidence from the rest of the Pueblo area generally agrees with this, but indicates that diagonal notching was an equally early technic which for some reason was not generally used after Pueblo III times for the small points that became the most popular. Practical experiments in hafting points might indicate reasons for using certain forms of notch for certain size or shapes of point.

The small points that came into use in the Jeddito district after the start of Pueblo III are often referred to as "typical" Pueblo points. They are small, very neatly made, with delicate notches. Awatovi, Kawaika-a and Chakpahu are the only Jeddito sites at which they were found, except for a single one at Pink Arrow. The majority are notched at the base as well as the sides. This feature serves to distinguish them from many otherwise similar points of New Mexico and Arizona and of Southern Utah and Colorado. Morris says of the La Plata district: "This is the typical and most numerous arrowpoint of the latest phases of Pueblo III in the La Plata country. The notch at the center of the base, as shown in [pl. 122] *v*, is extremely rare."[14] In New Mexico, "This is the predominant form of Pecos arrowhead. . . . There is considerable variation in the bases, which run from straight to rather deeply concave; most commonly they are slightly concave."[15] At a large number of the other sites for which there are adequate reports most of the small triangular side notched points are of the La Plata variety with straight base:

Chaco Canyon Bc 51
Tseh So
Leyit Kin
Kiatuthlanna Pueblo
Village of the Great Kivas
Whitewater
Starkweather
Mattocks
Tuzigoot
Sinagua Branch (unspecified sites)
White Dog Cave
Alkali Ridge (Pueblo II-III sites)
Lowry Ruin

At Snaketown, in the Snaketown and Sacaton Phase of the Hohokam culture, there were a few straight based, side notched triangular points, further indicating the wide distribution in the Southwest of these points from as early as the 8th or 10th centuries into historic times. These straight based side notched points later became common in the Hohokam area due to Salado (Pueblo) influence.[16]

The Pecos variety of side notched triangular point, with concave base, is much less commonly reported. They have been found at the Riana Ruin, in sites of the Rosa Phase, in unspecified Sinagua Branch sites, and at Fitzmaurice and Tuzigoot Ruins.

The Awatovi variety of side notched triangular point has a notched base. Such points are reported from only a few sites in the Pueblo area, at Riana Ruin, rarely in the Sinagua Branch and at sites on the Upper Gila explored by Hough. The shape also occurs in sites of the Rosa Phase, and in the Hohokam (Sacaton Phase only, and rare). In Utah it seems to have considerable antiquity, and to have persisted until modern times. Its reported occurrences are in the Promontory Point Culture,[17] and in both the Northern Utah "puebloan" pithouses and modern Shoshonean sites.[18] This northern distribution may be significant because of the linguistic affiliation of the Hopi with Shoshoneans of the Great Basin. The Hopi are the only Shoshonean speakers among the Pueblos. They are, of course, distinctly different in most cultural traits from such Shoshonean speaking tribes as the Paiute, Ute and Comanche. This special shape of chipped point is a tenuous link between the 17th century ancestors of the modern Hopi and the putative northern Utah precursors of the Paiute. It is worth noting, however, because it parallels the linguistic connection.[19] This particular shape of point has also been reported from the Texas plains, far to the east of the Pueblo area. Hence, its origin and spread cannot be fully explored without going beyond the limits of this study, into the problem of the relationship between the Puebloan peoples and those of the central and southern Plains.[20]

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[6] Roberts, 1930, p. 152, pl. 50, *d*, *f*.
[7] Roberts, 1931, pp. 157–59, pl. 38, *a–d*.
[8] Roberts, 1929b, pp. 138–39, pl. 28, *c*, *g*.
[9] Roberts, 1940, p. 123, pl. 45, *c*, *d*, *e*, pl. 46, *e*.
[10] Guernsey and Kidder, 1921, pp. 94–95, pl. 35, *k*, *l*.
[11] Pepper, 1920, p. 326, fig. 134.
[12] Broken Roof Cave, Guernsey, 1931, p. 73, pl. 34, *e*.
[13] White Dog Cave, Guernsey and Kidder, 1921, p. 87, pl. 34, *f*, *j*.
[14] Morris, 1939, p. 126.
[15] Kidder, 1932, pp. 20–22, fig. 4.
[16] Haury, 1945a, pl. 35.

DIAGONAL NOTCHED POINTS

SLENDER, BARBED DIAGONAL NOTCHED POINTS

FIGURES 25, *n*, and 26, *n*.

Description. These points are distinguished by relatively slender down-raking barbs, which sometimes curve outward slightly, resulting in what has been called a "firtree" shape. The points are approximately triangular. The stem is slender and expanded at the base. Workmanship is excellent on the two points of chert, poorer on the obsidian. Figure 25, *n* from Site 264 (Basket Maker III-early Pueblo I) is a flake of obsidian with only a very minute retouch on the edges, on both faces, resulting in its shape. Since this is the only obsidian point earlier than Pueblo IV from any Jeddito site, the rather crude workmanship might be regarded as due to unfamiliarity with the material and its qualities, or of the desire to use even a somewhat unpromising flake of this rare material.

Size. Figure 26, *n* is the only whole point; it is 3.0 by 1.6 by 0.4 centimeters. The others would have originally been about the same or slightly shorter.

Material.	Chert	2
	Obsidian	2
Provenience.	Site 264, BM III-early P I	1
	Site 4A, P I-II	1
	Awatovi, P V (17c)	1
	" Unassigned	1
	Total	4

BROAD, SHOULDERED OR BARBED DIAGONAL NOTCHED POINTS

FIGURES 25, *r*, *s*; 26, *q*, *s*; 27, *d*, *l*.

Description. Triangular blades with straight or convex edges, maximum width at shoulder. Besides being wider than the preceding group, these points are less uniform in shape. Notches, here classed as diagonal, are sometimes termed "corner removed" since they are broad indentations separating the shoulder from the stem. Shoulders vary from perpendicular to the long axis to conspicuously down raking. Two (Awatovi, P V) have an additional notch on the sides above the shoulder. Two (Site 18 and Kawaika-a) have notched or deeply concave bases. Workmanship is generally excellent, although on a few points there remain portions that the artisan did not remove due to refractory material or to the inadequacy of his flaking technic.

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[17] Steward, 1937a, pp. 13, 83–84, fig. 4.

[18] Steward, 1933a, p. 18, fig. 7.

[19] The whole question of relationships between the Hopi and various archæological horizons, particularly of Utah, is analyzed in Zingg's "A reconstruction of Uto-Aztekan History." As pointed out in M. K. Opler's review (1940), Steward's data are unfortunately omitted from consideration. In addition, I have found Zingg's study disappointing and difficult to use because of its factual errors and its mixture of assumption, speculation and theory with the facts on which they are presumably based.

[20] Krieger, 1946 makes a brilliant start on this entire problem.

Size. Length 5.0 cm, or over (maximum over 9.0 cm.)	3
Length 3.0 to 4.9 cm.	7
Length less than 3.0 cm. (minimum 1.9 cm.	4

Others too fragmentary to determine length.

Material. Chert

Provenience.	Site 264, BM III-early P I	2
	Site 4A, Unassigned	1
	Site 6, BM III-P I	1
	Site 18, P II	1
	Site 108, P II-III	1
	Awatovi, P III (B/W)	1
	" P III (W-O)	1
	" P IV (Y-17)	2
	" P V (17c)	4
	" Unassigned	6
	Kawaika-a, P III-IV	2
	Total	22

TAPERED STEMMED DIAGONAL NOTCHED POINTS

Figure 25, *w*, *x*.

Description. Triangular blades, notched at the corners, leaving a stem which tapers to a narrow base. Although these notches are considerably wider than on most other diagonal notched points, they are similar in having the axis of the notch oblique to the long axis of the point. The shoulders of three are barbed (down raking), and four have square or sloped shoulders, poorly chipped and irregular.

Size. Length 3.0 cm. or more (maximum 4.9 cm.)	5
Length less than 3.0 cm. (minimum 2.1 cm.)	2

Material. Chert

Provenience.	Awatovi, P IV (Y-17)	2
	" P V (17c)	2
	Awatovi, Unassigned	2
	Kawaika-a, P III-IV	1
	Total	7

OCCURRENCE OF DIAGONAL NOTCHED POINTS IN THE PUEBLO AREA

Diagonal notched points (also sometimes called corner notched) are relatively more numerous in Basket Maker III and Pueblo I-II sites of the Jeddito district than they are later. The differences between the slender barbed form and the broad form are relatively slight, but it is the second of these, broad and with an expanding broad-based stem that persists in greatest number into the later horizons. Elsewhere in the Southwest the same situation exists. Almost every early Pueblo site of Basket Maker III and Pueblo I-II has a relatively large number of diagonal notched points, and at many later sites they still occur, but apparently in less abundance. One of the traits common to Mogollon and Pueblo sites, at least up to about the 10th century, is this small diagonal notched point with expanding stem, usually broader and with a more rounded base at Mogollon sites than at Pueblo.[21]

The early Jeddito sites lacked the large leaf-shaped blades with diagonal notches which are common in some contemporary sites, such as those of Pueblo I and II in the Piedra district,[22] at Kiatuthlanna (Pueblo II),[23] and at White Dog Cave (Basket Maker III).[24] Implements of this shape occur in the La Plata district, but are not identified as to site or chronological period.[25] The absence of this distinctive diagonal notched form in the Jeddito district is paralleled by the general scarcity of Basket Maker III and Pueblo I-II chipped stone. Enough digging was done in sites of these periods to provide an adequate sample of their artifacts, so this lack must be considered characteristic of the Jeddito district at this time.

Diagonally notched points are extremely rare in the Hohokam culture. However, one very much like those of the Pueblo area (Basket Maker III-Pueblo I) appears in Sayles' "Development Chart" of chipped stone at Snaketown, assigned to the Snaketown Phase.[26] In the tables of frequency and type such points appear only in the Vahki, Gila Butte and later phases. But in spite of this uncertainty as to their date, and the further doubts concerning dates for all the early Hohokam phases, these points of Pueblo form can be tentatively considered as of 7th to 10th century date. Consequently, they might be intrusives from the north.

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[21] Rinaldo, 1941b, p. 13. Such opinions, of course, must be somewhat impressionistic because of the lack of sufficient data from sites of different periods in each locality. Quantitative treatment of archæological data is rarely possible, at present.

[22] Roberts, 1930.

[23] Roberts, 1931.

[24] Guernsey and Kidder, 1921.

[25] Morris, 1939. Such vagueness is much more frequent in other reports, reflecting the general preoccupation of Southwestern archæologists with pottery and architecture. I have found Roberts' reports, of those consulted in this study, the most consistently useful for both the descriptive detail and their succinct evaluations of stone artifacts.

When the Jeddito chipped points were classified, the diagonal notched points with tapered stem were separated from other points on the basis of their distinctive form. The unusual temporal distribution fully justifies this. They occur only in Pueblo IV and V, whereas the other diagonal notched points appear much earlier. Elsewhere tapered stemmed points have appeared occasionally, at the Bear Ruin, the Village of the Great Kivas, Mattocks Ruin, and Pueblo II sites in the San Francisco Mountains.

SERRATE POINTS

Figures 25, *a′*, *b′*, *c′* and 26, *k*, *l*.

DESCRIPTION

Various shapes, including two flakes which probably were not meant to be hafted, although the serrate edges might have made this possible. Five points have broad stems with the base notched, a shape similar to two points without serrations, described below (fig. 27, *h*, *j*). This broad, straight stem is a distinctive shape, relatively rare in the Southwest. The other serrate points are crude, stemless, with irregular serrations along the edges, of which those nearest the base might have served as notches for hafting, as in figure 26, *l*.

Size. Length 2.5 to 4.0 cm.

Material.	Chert	9
	Obsidian	2
Provenience.	Pink Arrow, P III-IV	1
	Awatovi, P V (17c)	4
	" Unassigned	6
	Kawaika-a, P III-IV	1
	Total	12

OCCURRENCE OF SERRATE POINTS

The most satisfactory definition of "serration" is that of Bryan and Toulouse,[27] "an edge consisting of more or less regularly spaced denticles formed as an inherent feature of the final retouch of the edge." A similar, but quite distinct treatment sometimes found on unshaped flakes was probably intended for sawing. They describe it as "characterized by regularly spaced notches chipped out of a previously prepared smooth edge." I would call this "saw-toothed" to distinguish it from "serrate."[28] Points with a somewhat sinuous edge, due to alternate retouching, should not be classified as serrate.

Chronologically, serrate points are late in the Jeddito district, two from Pueblo III-IV sites and others from Pueblo V. The only serrate points with long, straight stems reported elsewhere in the Southwest are:

- San Francisco Mountains Pueblo II sites, listed as an "odd form" (Bartlett, 1934, p. 17, fig. 14)
- Whitemound Village, Basket Maker III (Gladwin, 1945, p. xvii, *b*)
- Gleeson Site (Fulton and Tuthill, 1940, p. xxiii, 3rd row center)
- Pecos (Kidder, 1932, p. 23, fig. 8, *b*. Also unserrated fig. 8, *k*)
- Kokopnyama (Hough-Gates Collection, United States National Museum, No. 212978).
- Lobo and San José Complexes (Bryan and Toulouse, 1943)

The similarity of the Jeddito points to those of the non-ceramic San José Complex [29] of west-central New Mexico and with the Lobo Complex was confirmed by Dr. Bryan, who kindly examined the specimens. The similarity of these points, characteristic of these early complexes, and occurring occasionally later in the Southwest, may be more than coincidence. On the basis of geologic evidence for dating the San José Complex and related cultural complexes in Texas and southern Arizona, it might date from as early as 2000 B.C. or as late as A.D. 1400. The Lobo Complex succeeds it, and is associated with Pueblo I pottery. The San José Complex is believed to be non-agricultural, and the Lobo Complex may represent a continuation into the period of agricultural beginnings by the Puebloan peoples. It is entirely speculative to suggest that this may represent a non-Pueblo culture persisting within the area of Pueblo development, but such may have existed and sometimes furnished distinctive traits like these broad stemmed serrate points to the Pueblos, by means of occasional trade and contacts.

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[26] Sayles, 1937, p. 113, fig. 43.

[27] Bryan and Toulouse, 1943, p. 271, note 3.

[28] For an excellent illustration of saw-toothed implements from the Upper Gila area see Hough, 1914, pp. 22–23, fig. 30–33.

[29] The closest similarity in the Lobo Complex is with pl. xix, *n* and *o*, Bryan and Toulouse, 1943, and in the San José Complex with pl. xix, *e′*–*h′*.

Serrate points of the triangular (generally) stemless type are characteristic of the Hohokam culture, beginning with the latter part of the Colonial Period,[30] and of the Mogollon Culture beginning in the Three-Circle Phase.[31] Serrate points in the Pueblo area, other than the broad stemmed form discussed above, may all be trade pieces from the Hohokam, or indirectly due to Hohokam influence. They have been reported at several widely scattered sites:

La Plata district, surface finds, "rare" (Morris, 1939, p. 127, pl. 129, *d, e*)
Pecos, "exceedingly rare" (Kidder, 1932, fig. 8, *a–c*)
Jemez Cave (Alexander and Reiter, 1935, p. 17, *g, h*)
Sunset Crater, NA 1551 (McGregor, 1936, p. 32, fig. XIV, *k*)
Grand Falls Pueblo, NA 1600 (McGregor, 1936, p. 32)
Upper Gila sites (Hough, 1914, p. 19, fig. 142)
Winona and Ridge Ruin (McGregor, 1941, p. 182, fig. 64, O, Q)

CHIPPED IMPLEMENTS OF OTHER SHAPES

BROAD STRAIGHT STEMMED POINTS

Figure 27, *i* is a fragment similar in shape to some of the serrate points, but lacking their serration and considerably larger than them. Present length 4.0 centimeters, originally probably over 8 centimeters. Awatovi Unassigned.

Figure 27, *h* and two similar points not illustrated have rounded or triangular blades, and large straight stems. Length 3.4 to 5.0 centimeters. Awatovi, Pueblo IV (B/Y) and Pueblo V (17c).

BASAL TIT POINT

Figure 25, *j* is a fragment of a slender triangular point, probably originally about 5 centimeters long. The base has a small projection in the center, with two shallow notches either side. Obsidian. Awatovi Unassigned. Such points also occur in the Walhalla Glades of the Grand Canyon[32] and in the Red Mesa Phase (Basket Maker III) of the Chaco Branch.[33]

STEMMED LENTICULAR POINTS

Figure 27, *e* and a similar point not illustrated are leaf-shaped with crudely made tapered stems. Maximum width near the midpoint of the blade. Their edges are extremely worn, and the faces partly smoothed, as though from long continued wear. Length 7.5 and 6 to 7 centimeters. Awatovi, Pueblo V (17c).

GUN FLINTS (?)

Figure 26, *b, c, d* and another similar object are small rectangles that have been shaped by step flaking from both sides, leaving the center thick. It is possible that they were made for gun flints, under Spanish direction, since they are unlike any other chipped objects. Only one was associated with 17th century materials, the others coming from the surface at Awatovi. They are of chert, and are about 3 centimeters long, 2 centimeters wide and 0.6 to 1.0 centimeter thick. They lack the precise shape and bevelled surfaces which characterize modern English gun flints.[34] However, if they really are gun flints, crudity would be expected, as any substitute would have to do at such a remote outpost of the Spanish frontier. The only other objects like these reported from the Southwest came from Pecos, where, of course, there was considerable military activity as well as a Spanish mission. Kidder writes:

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[30] A single earlier specimen comes from the Snaketown site, assigned to the Pioneer Period, Sayles, 1937, pp. 109, 113, fig. 43, pl. LXXXV-XCI, XCIV. Another slender serrate point, perhaps contemporary with the Pioneer Period, comes from Bear Ruin, Haury, 1940, p. 105, fig. 38, *a*.

[31] Haury, 1936, p. 108, fig. 30. A single serrate point from Mogollon Village (pl. XVIII, *e*) may be earlier, but is regarded by Haury as a possible intrusive from Texas.

[32] Hall, 1942, pp. 23–24, fig. 13, *p*.

[33] Gladwin, 1945, p. 57, pl. XXXI, *j*.

> Four little flat, rectangular objects, three of quartz, each about ¾ of an inch square (one illustrated in fig. 17, *d*) and one of obsidian, 1 inch long by ½ inch wide, were taken from the refuse. In shape they resemble small gun-flints, but one of the quartz specimens is from a deposit almost surely prehistoric; and the one of obsidian is much too delicate to have served such a purpose.[35]

Gun flints have not been reported at other Mission sites of New Mexico, although several have been partly excavated (Kuaua, Abo, Quarai, etc.).[36]

FLUTED POINTS

Figure 25, *y* is leaf shaped with slightly concave base. A broad flake has been removed on each side of the base for about one-third the length of the blade. Material, light gray chert, finely crackled from exposure to heat. Awatovi, Pueblo V (17c).

Figure 25, *z* is the basal fragment of a black, opaque obsidian point with several short flakes removed to form a short channel up from the concave base. Awatovi Unassigned.

These points are very suggestive of Folsom points, and might have been picked up and saved by the Indians, when they were found washed out of some stream bank, originally coming from a much more remote period than the Basket Maker-Pueblo occupation.

REWORKED OR UNFINISHED POINTS

There are several artifacts that seem to be unfinished or reworked points. Some have a single notch, or have notches placed asymmetrically, as though the maker were inept or unsure of his purpose. Others have been discarded before being completed because they were too thick or irregular to be worth further efforts to shape them. At least eight show some wear on the edges, indicating that they were used even in an unfinished or unsymmetrical condition. None resemble the corner-tang artifacts of Texas.

Provenience.	Pink Arrow, P III-IV	2
	Awatovi, P V (17c)	9
	" Unassigned	12
	Kawaika-a, P III-IV	1
	Total	24

CONCAVE EDGE SCRAPERS

Figure 26, *i* and another similar object have three or four deeply concave edges showing wear, as though used for scraping. They would be suitable for use on sticks of less than 0.5 centimeter diameter, and perhaps for sinew or small bones. Except for the concave edges they do not seem to be purposefully shaped. Both are 2.1 centimeters across. Chert and obsidian. Awatovi, Pueblo IV (Y-17) and Chakpahu.

FRAGMENTS, UNCLASSIFIED

Description. These are mostly tips of chipped implements, and could come from a variety of shapes. Several small fragments include part of a notch, but not enough to permit assignment to one of the categories.

Size. Originally some of these may have been 5 or 6 centimeters long, but most of them were probably 2 to 4 centimeters long.

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[34] Barnes and Knowles, 1937, p. 55.

[35] Kidder, 1932, p. 35.

[36] Robert H. Lister informed me that he knew of no gun flints having been found at any of these excavations. However, Dr. Kirk Bryan told me that he once picked up a gun flint at Galisteo Pueblo, and gave it to Dr. Clark Wissler.

Material.	Chert	41
	Obsidian	7
Provenience.	Site 4A, Unassigned	2
	Site 108, P II-III	1
	Pink Arrow, P III-IV	2
	Awatovi, P IV (O-Y)	1
	Awatovi, P IV (B/Y)	4
	" P IV (Y-17)	4
	" P V (17c)	9
	" Unassigned	25
	Total	48

CHRONOLOGICAL CHANGES IN SIZE OF JEDDITO POINTS

Although whole specimens are not plentiful from the earlier Jeddito sites, comparison of the few found with the more plentiful later material failed to reveal any great changes in size. The largest chipped tools, the stemless blades, come mainly from late Pueblo III and later. Two early stemless blades are less than 2.5 centimeters long, in contrast to blades of similar leaf shape from Awatovi with lengths of 8, 10 and 14 centimeters.

The only notched or stemmed points from Basket Maker III-Pueblo I horizon average about 3 centimeters long. The small triangular notched points with straight, concave or notched base appear in Pueblo IV. They are smaller than any other group of points, with a mean length of about 2.5 centimeters. However, other Pueblo IV and V points are longer, about the same as those of the earliest Jeddito sites. Consequently, the expectation that a progressive decrease in size would be shown failed to be realized. Instead, both stemmed and stemless points show their greatest length in Pueblo III and IV. The mean lengths in each of five successive periods are shown in table 13, based on a total of 85 chipped points which were whole and came from satisfactorily dated associations.

Table 13: Chronological Changes in Size of Jeddito Points (Mean length in centimeters based on the number of specimens in parentheses in each instance.)

	Stemless Points		Stemmed Points	
Basket Maker III-early Pueblo I	2.2	(1)	3.0	(5)
Pueblo I-II	2.4	(1)	3.2	(2)
Pueblo III-early Pueblo IV	10.7	(3)	4.1	(5)
Pueblo IV	7.4	(6)	3.9	(11)
Pueblo V	5.8	(15)	2.7	(35)

DRILLS

DEFINITION AND CLASSIFICATION

Drills are implements of a slender shape, with a small point at one end, which were probably used for perforation of wood and soft mineral materials. Examination for wear at the tip will show whether it was used for drilling, since shapes are not always easily distinguishable from projectile points, It is not known whether all of them were hafted, but the small size of most and the notches near the base of some make a wooden handle probable. Only the largest and widest can be held firmly in the fingers in their present state.

Gebhard[37] suggests that the term be limited to objects that (1) show wear on the point as if used for rotary piercing, and (2) are too slender to have served as projectile points. The first criterion can invariably be followed, but judgments as to the second will vary.

Drills have been classified here primarily by the shape of the base, following the example of Kidder in "The Artifacts of Pecos," and Morris in "Archæological Studies in the La Plata District." The bases vary from extremely broad to as slender as the drill's shaft. Some are notched, and some are not. A few are included on the basis of shape, although with tips missing their use as drills cannot be proved.

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[37] Gebhard, 1946, p. 261.

PLAIN SHAFTED DRILLS

FIGURE 28, *e*.

Description. Slightly tapered to parallel sided, with no stem or special treatment of the base. Cross-section relatively thick. Base rounded or roughly square. The obsidian specimen is worn very smooth for its entire length, as well as at the tip.

Size. Length 2.3 to 4.2 centimeters
Width 0.8 to 1.3 centimeters

The smallest of these drills are smaller than those of any other shape.

Material.	Chert	9
	Obsidian	1
Provenience.	Site 264, BM III-early P I	1
	Awatovi, P III (B/W)	1
	” P IV (B/Y)	1
	” P V (17c)	3
	” Unassigned	3
	Kawaika-a, P III-IV	1
	Total	10

DRILLS WITH SHAFT WIDENED AT MIDDLE

FIGURE 26, *e*; 28, *a*, *h*.

Description. Maximum width occurs a third or fourth of the way from the base, and edges taper towards both ends. Cross-section relatively thin.

Size. The largest (fig. 28, *a*) is 12.0 by 3.3 by 0.8 centimeters, larger than drills of any other shapes. Others in this group are from 6.8 to 4.5 centimeters long.

Material. Chert.

Provenience.	Awatovi, P IV(B/Y)	1
	” P V (17c)	3
	” Unassigned	1
	Total	5

TRIANGULAR DRILLS

FIGURE 28, *d*, *f*.

Description. Greatest width at the base, and sides more or less straight. Shape is triangular, in contrast to the drills with expanded base. Workmanship rather crude, some bases irregular and convex, others straight.

Size. Length 6.8 to 3.7 centimeters
Width 2.4 to 1.1 centimeters

Material.	Chert	8
	Obsidian	1
Provenience.	Awatovi, P IV (B/Y)	4
	” P V (17c)	2
	” Unassigned	3
	Total	9

EXPANDED BASE DRILLS

FIGURE 28, *c*, *i*.

Description. Base is differentiated from the tapered shaft by a distinct shoulder, below which base broadens. Bases are rounded (5) or irregular (1, a flake with little attempt to shape the implement except along the shaft).

Size.	Length from 4.7 to 8.9 cm.	4
	Lengths: 2.4 and 3.6 cm.	2

Material. Chert.

Provenience.	Awatovi, P III (B/O)	1
	” P IV (B/Y)	1
	” P V (17c)	2
	” Unassigned	2
	Total	6

SIDE NOTCHED DRILLS

FIGURES 26, *a*, *f*, *g*; 28, *b*.

Description. These are not reworked projectile points or knives, because they are too long and slender and have bases unlike any occurring on the points and blades described above. Most have expanded bases, with relatively slender shafts. A pair of notches, usually rather wide and shallow, occupies the sides close to the base.

Size.	Length 5.0 cm. or more (maximum 9.4 cm.)	7
	Length less than 5.0 cm. (minimum 3.1 cm.)	6
Material.	Chert	12
	Obsidian	1
Provenience.	Site 264, BM III-early P I	1
	Site 105, P II-III	1
	Pink Arrow, P III-IV	1
	Awatovi, P IV (Y-17)	2
	” P V (17c)	4
	” Unassigned	3
	Kawaika-a, P III-IV	1
	Total	13

FLAKE DRILLS

Figure 28, *g*.

Description. Flakes of fortuitous shapes, with little or no retouch necessary to produce a point that would be suitable for piercing. Only the wear on these points, which shows that they were used, distinguishes these drills from many of the unretouched flakes of similar shapes that were not used as drills.

Size. 3 to 6 centimeters long.

Material. Chert.

Provenience.	Awatovi,	P IV (B/Y)	3
	"	P IV (Y-17)	1
	"	P V (17c)	1
	"	Unassigned	1
	Total		6

OCCURRENCE OF DRILLS IN THE PUEBLO AREA

Information on which to base an analysis of the distribution of chipped drills of various shapes is almost entirely lacking for the Southwest. A few remarks can be made, but no conclusions drawn.

Plain Shafted Drills were found at Jeddito, Site 264, although they are generally absent at Basket Maker III and Pueblo I sites. They have been reported from Mogollon Village,[38] another indication of some connection between Site 264 and the Mogollon Rim area. The only drills reported from Snaketown, our chief source of information on the earlier Hohokam periods, were of this form, and were assigned to the Pioneer Period.[39]

Drills with Shaft Widened at Middle are apparently late, as the Jeddito occurrences were at Awatovi, in Pueblo IV and V. The only comparable drills reported elsewhere are at Pecos,[40] and a single surface find in the La Plata district.[41]

Triangular Drills occurred at Pueblo IV and V Awatovi, at Grand Falls, Arizona (Pueblo I), at Kiatuthlanna (Pueblo I) and in the SU Site (Pinelawn Phase of the Mogollon).

Expanded Base Drills, which came from Pueblo III to V levels of Awatovi, are surprisingly absent at earlier Jeddito sites. Rinaldo, in a survey of Pueblo material culture, concluded that the characteristic drill of Basket Maker III and Pueblo I-II was widened at the base. Later, he observed, the shape becomes closer to a "T", the form he considered characteristic of Pueblo III and IV.[42] No expanded base drills were found at earlier Jeddito sites, but those drills found at Awatovi are similar to drills from a great many other sites. The data need not be cited here; they bear out Rinaldo's conclusions, and make it hard to understand why the form was absent in the Jeddito district until Pueblo III. Such a drill, incidentally, is illustrated by A. M. Stephen as part of the costume of the Hopi Snake Dancers in 1892.[43]

Side Notched Drills occur in the Jeddito area from Pueblo II-III onward. Occasionally, in various parts of the Southwest, such drills are reworked points or blades. Since side notched points were fairly common in the Jeddito sites, it may be an accidental result of the small sample that none were found re-used as drills. Drills made as such, and notched on the sides, occur at Pecos, where Kidder suggested they might be an indication of the eastern contacts of the site. However, such points are reported from Mogollon Village, from Bear Ruin and from Chaco Canyon Bc 51, as well as Jeddito Site 105 (fig. 26, *a*), which reduces the probability of an eastern origin for the Pecos specimens.

CORES

Figure 27, *r*, *s*.

Description. Most of the cores from which flakes had been removed for the manufacture of points, knives, scrapers, drills, etc., were probably used as hammerstones, or else left at the distant outcroppings where chert and obsidian were obtained. Only a few cores were

[38] Haury, 1936, p. xviii, g.

[39] Sayles, 1937, p. 112, pl. XCIV, *c*, *h*.

[40] Kidder, 1932, p. 27, fig. 9, *d*, 11, *a–c*.

[41] Morris, 1939, p. 126, pl. 127, *b*.

[42] Rinaldo, 1941a, p. 139.

[43] Parsons, 1936b, p. 751, fig. 405.

found at the sites. They had had flakes removed, but had served no further purpose. They had all been reduced to a condition where the removal of more flakes would be extremely difficult.

Size. Largest diameter from 4 to 10 centimeters.

Material.		
	Chert	24
	Quartzite	2
	Obsidian	3

Provenience.		
Site 111,	P II	1
Site 169,	P II	1
Site 105,	P II-III	1
Site 108,	P II-III	1
Site 231,	P III	1
Pink Arrow,	P III-IV	3
Awatovi,	P IV (B/Y)	1
”	P IV (Y-17)	9
”	P V (17c)	8
”	Unassigned	3
Total		29

"CHOPPERS"

Figure 27, *t, u, v.*

Definition. Roughly chipped or flaked tools large enough to have served as "hand axes" and having one end or part of the edge sharpened by flaking. Their use is unknown.

Description. These are both cores and flakes with part of the edge sharpened and a portion blunt. Only a few have any of the original cortex or weathered surface still showing. The size and thickness of these tools distinguishes them from the smaller chipped tools which are believed to have been used as knives and scrapers. Their sinuous edges are due to the coarseness of the flaking, and would render them unsuitable for fine work. The superficial resemblance to Old World Palæolithic chopping tools is a coincidence, with no historical significance. These Jeddito implements are few in number, and carelessly made, as though to serve only an occasional need. They never became plentiful or standardized in form.

Size. Length 6 to 10 centimeters
Width 4 to 9 centimeters
Thickness 1.5 to 3 centimeters

Material.		
	Basalt	3
	Chert	10

Provenience.		
Site 264,	BM III-early P I	1
Site 169,	P II	1
Pink Arrow,	P III-IV	1
Awatovi,	P III (B/O)	1
”	P IV (O-Y)	2
”	P IV (B/Y)	2
”	P IV (Y-17)	3
”	P V (17c)	1
”	Unassigned	1
Total		13

SNUB-NOSED SCRAPERS

Figure 27, *o, p, q.*

Description. Although many of the retouched flakes have been sharpened on the ends, there are only a few that have a particularly steep retouch, restricted to the larger end of the flake. These tools are made of flakes thicker than average, with one face nearly flat and lacking any retouch. On the convex face the retouch is concentrated at the larger end, and is so steep as to make an angle of 50° to almost 90° with the other surface.

Size. The largest is 8.5 by 5.5 by 2.8 centimeters. The smallest is 3.8 by 3.0 by 0.8 centimeters. Others are intermediate in all three dimensions.

Material.		
	Chert	8
	Quartzite	2
	Obsidian	1

Provenience.		
Awatovi,	P IV (O-Y)	1
”	P IV (B/Y)	3
”	P IV (Y-17)	2
”	P V (17c)	4
Kokopnyama,	P III-IV	1
Total		11

Discussion. Snub-nosed scrapers are characteristic of some of the Plains cultures, where they are much more numerous than anywhere in the Southwest. Since they are one of the forms of artifact with a demonstrable antiquity in the Southwest,[44] and also occur in the early Mogollon culture,[45] it is possible that they have persisted over this long period without being re-introduced from the Plains to New Mexico and Arizona. However, they are rare in Pueblo sites, so that at Pecos their appearance in considerable abundance in Pueblo IV is a strong indication of diffusion from the Plains.[46] The few snub-nosed scrapers of the Jeddito district appear at this time also, so contacts with the Pueblos to the east may be responsible for them, rather than diffusion from a hypothetical survival along the Mogollon Rim.

It is interesting to note that snub-nosed scrapers have been regarded as an outstanding example "of an implement having nearly world-wide distribution."[47] The similarity is striking between New World snub-nosed scrapers and those of the Mesolithic horizons of the Old World, in spite of the great separation in both time and space.

UNSHAPED FLAKE TOOLS

RETOUCH ON BOTH FACES

Description. A variety of shapes, all fortuitous, had been selected and sharpened by retouching in several ways. The commonest was to sharpen a long, fairly straight edge by chipping on only one face, then to turn the flake over and sharpen the other edge similarly. Since the flake was held in the left hand and the flaker or fabricator in the right, the retouch of the two edges is always on opposite faces. Less frequently a single edge was sharpened, by retouching it from both faces. Comparison of the flakes with edges retouched with those lacking retouch suggests that a certain amount of selection has taken place. Slender triangular or parallel edged flakes were preferred for retouching. Also, the majority are of a size that can be held conveniently in the fingers, with none of the smallest flakes selected.

Size. Nearly all the flakes are between 3 and 7 centimeters long.

Material. Mainly chert, with obsidian used for 27 per cent, and a very few of quartzite. The obsidian is only from later horizons, Pueblo IV and V at Awatovi, and from Kawaika-a and Chakpahu.

Provenience.

Pink Arrow,	P III-IV	2
Awatovi,	P III (B/W)	1
"	P III (B/O)	1
"	P IV (O-Y)	4
"	P IV (B/Y)	22
Awatovi,	P IV (Y-17)	8
"	P V (17c)	47
"	Unassigned	56
Kawaika-a,	P III-IV	6
Chakpahu,	P III-IV	1
Total		148

Specimen *in situ.* Awatovi, Pueblo IV (O-Y), Test 14, Room 10, a kiva, had a single flake lying on the floor.

RETOUCH ON ONE FACE

Description. As in the preceding group, accidentally shaped flakes were selected, mainly of elongated triangular or parallel sided shapes, but with great variety in details. The retouch by which one edge was sharpened was limited to one face, and if the other edge was retouched it was done on the same face. Flakes retouched on both edges were generally those with one very flat face, requiring that the retouch be on the other (convex) surface.

Size. Nearly all the flakes are between 3 and 6 centimeters long.

Material. Majority of chert, with obsidian used for 36 per cent, and a few of quartzite and petrified wood. Obsidian comes only from the large sites of Pueblo III and IV date, and from Awatovi.

Provenience.

Site 264,	BM III-early P I	1
Site 111,	P II	2

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[44] For example, Sandia Cave (Hibben, 1941, p. 25), Lake Mohave (Amsden, 1937, p. 63), San Jon (Roberts, 1942, p. 12).

[45] Bear Ruin (Haury, 1940, p. 107, fig. 39, *f*) and SU Site (Rinaldo, 1943, p. 212).

[46] Kidder, 1932, p. 44. Krieger, 1946, p. 62.

[47] Nelson, 1937, p. 269.

Pink Arrow, P III-IV		4
Awatovi,	P III (B/W)	2
"	P III (B/O)	2
"	P IV (O-Y)	11
"	P IV (B/Y)	104
"	P IV (Y-17)	49
"	P V (17c)	124
"	Unassigned	256
Kawaika-a, P III-IV		15
Old Shungopovi, P IV-V?		8
Chakpahu, P III-IV		6
Kokopnyama, P III-IV		2
Total		586

Specimen *in situ*. Awatovi, Pueblo IV (B/Y), Test 14, Room 4, a kiva, had a pot set into the floor under the paving. In this was a single obsidian flake.

NO RETOUCH

Description. Although an effort was made to save all flakes of stone that showed any indication of having been used, whether or not purposefully shaped, some were doubtless overlooked during the digging. In the smaller sites the relatively small amount of cultural material made it easy to save even small and little used chips of stone. At Awatovi, however, only a sample of the scraps of chert was generally saved, because the abundance of other material often overshadowed such inconspicuous stone chips. Nevertheless, it is certain that the amount of unworked chert and obsidian in the form of cores or flakes was very small as compared to Pecos. Kidder states that the number of unworked flakes at Pecos was probably many times the total of all other chipped stone artifacts. At Awatovi, in contrast, such flakes were not much more plentiful than were shaped points and blades. One explanation of this would be that very little primary stone chipping was done at Awatovi. The finished implements generally seem to have been brought to the town, after being made elsewhere. There are no close sources of chert or obsidian in quantity, and of course, transportation of the finished product would be easier than of the raw materials. At Pecos, to judge from the quantity of scraps and chips, a good deal of the flint chipping was done at the town.

In the present collection, the unworked flakes generally show evidence of having been used for cutting and scraping. Although the edges are not retouched, they are dulled in a characteristic way, namely, the removal of a series of almost microscopic step-flakes, each one short and ending in a tiny hinge-fracture. Edges that were not used appear clean and sharp under a hand lens, in contrast to the ragged appearance of those dulled by use. Flakes of almost any shape were used, but the very small flakes that resulted from flint chipping were very seldom employed. All but three of the chips from Pueblo III (B/W) at Awatovi were found together (Room 207, Lower). They were fragments of chert of the same color and texture, probably from the same nodule. Although found in rubbish, it is possible that these scraps are from a "workshop" where chipped implements were produced.

Size. Nearly all the flakes are from 3 to 6 centimeters long.

Material. Mostly chert, with 25 per cent obsidian. Obsidian came from the surface of Site 4A (1 flake), Awatovi Pueblo III (1 flake) and otherwise from Pueblo IV and V associations.

Provenience.

Site 264, BM III-early P I		4
Sites 4, 4A, BM III-early P I		4
Sites 4, 4A, Unassigned		3
Site 111, P II		2
Site 169, P II		4
Site 105, P II-III		1
Site 231, P III		2
Pink Arrow, P III-IV		5
Awatovi,	P III (B/W)	50
"	P IV (O-Y)	2
"	P IV (B/Y)	16
"	P IV (Y-17)	18
"	P V (17c)	66
"	Unassigned	121
Kawaika-a, P III-IV		30
Old Shungopovi, P IV-V ?		7
Total		335

Specimens *in situ*. Site 264, two flakes on bench of Room 30, a pithouse. Awatovi, Pueblo IV (Y-17), Test 14, Room 5, a kiva, had a pot set under the northwest corner of the bench. In it were a hammerstone, several pieces of malachite and chalk, a simple grooved abrader, and four flakes of chert. One of these had a single face retouched, the others were not retouched. This collection of objects seems to be more than a chance association. They may be a tool kit, kept in this cache under the kiva bench for use in preparing ceremonial equipment. Modern accounts of Hopi ceremonies include the mention of considerable activity in the kivas in making and refurbishing masks, costumes and prayersticks before any major ceremony.

DISCUSSION OF UNSHAPED FLAKE TOOLS

Scrapers and knives made by the retouching of flakes, or flakes so used without any special preparation, are found so commonly throughout the Southwest that it is hard to find any areal or chronological distinctions in their distribution. But an analysis of the Jeddito specimens shows that from Pueblo III onward there was an increase in the practice of retouching the flakes, thus producing more regular edges, and edges as sharp as and less fragile than the plain edges of unworked flakes. The end scraper, too, appears in Pueblo IV, as another more specialized form of flake tool. The frequency of occurrence of each of the three unshaped flake tools is shown in table 14.

TABLE 14: Proportion of Unshaped Flake Tools with Retouch on Both, One, or Neither Faces, in Various Chronological Periods in the Jeddito District.

	Retouch Both Faces	Retouch One Face	No Retouch	Total Specimens
Basket-Maker III-Pueblo I	0%	11%	89%	9
Pueblo I-II and II-III	0	25	75	8
Pueblo III	3	7	90	58
Pueblo IV	14	70	16	236
Pueblo V	20	52	28	237

These figures indicate an increasing specialization of cutting and scraping tools. In addition, there was a parallel increase in the number of flake tools in comparison with ground and pecked tools, although they never formed more than about 10 per cent of the total. The cause of such an increase in specialized flake tools, and flake tools in general might be one or more of the following: (1) more work on such materials as wood and leather, for which flakes would be very useful; (2) more abundant supplies of chert and obsidian, resulting in the frequent discarding of used flakes and making of new ones, thus increasing the total number; (3) a change in the locations where the tools were used, so that they found their way into household rubbish instead of being left at distant points where they would not be found. Aside from these "practical" explanations, there may have been, of course, a change in habits or in tastes in various handicrafts that would involve the increasing use of these flake tools. At Pecos, Kidder noted almost no change "either in frequency or in type" of chipped stone until late Glaze IV times (that is, the end of the 16th century). Then there was "an influx of snub-nosed scrapers, two-edged knives, and side-scrapers." They were mostly made from stone from the Amarillo area, and of characteristic Plains forms, "hence it is evident that their appearance at Pecos indicates an intensification of contact with tribes to the east."[48] Unfortunately, details on the abundance of various forms of flake tools are not available in the regions whence influences on Awatovi might be expected. Such inconspicuous tools rarely receive any serious attention in reports, and have generally not even been tabulated in archæological field work. Whether any such change as took place in the Jeddito district occurred elsewhere in Arizona is unknown.

[48] Kidder, 1932, pp. 43–44.

USE OF CHIPPED IMPLEMENTS

The terminology of chipped stone implements has customarily been quite explicit as to function, but unfortunately such terms as arrowpoint, spearpoint and knife have usually been applied in ignorance or disregard of the actual potentialities of the implements concerned, and often with no evidence at all for the attributed functions. I believe that the use or uses of many chipped implements will always remain doubtful, although reasonable and probable uses for some can be determined. Lacking good evidence of function, or with evidence of multiple functions, only the most general, non-committal terms ought to be used. That is why "points" and "blades" have been discussed in preceding paragraphs more often than arrowheads or knives. The term "biface" might be the best to use, applying to any tool chipped on both faces, since it carries no implications of function. However, it has been used with more specialized meaning in European and Asiatic archæology, and is unfamiliar to many Southwesternists, so it has not been used here.

No Jeddito chipped tools were found with hafts preserved, or *in situ* with evidence of their use. But elsewhere in the Southwest evidence has been accumulated suggesting certain specific uses, and observations have been made that tend to eliminate others. These data will now be reviewed.

First, size *cannot* be used as a basis for the differentiation of spearheads and arrowheads, except possibly at the extremes of the ranges. Such a distinction has been made frequently, on the assumption that only small points would be light enough to be put on arrows. But there is doubt that the larger points would be any more suitable on spears, either. Practical experiments by an expert archer led him to prefer stone blades "from 20 to 25 mm. in width and from 30 to 50 mm. in length" for tipping arrows, and to regard larger blades as suitable for knives or lances (thrusting), but neither for arrows nor for spears (throwing).[49] Roberts recently abandoned the practice of reporting "spearheads" and "arrowheads," with size the chief distinction, and reported all the Whitewater Village specimens as "projectile points."[50]

Even the group of implements regarded by Roberts, and many other competent archæologists, as "projectile points," however, include a large proportion of tools that may have had other uses. A single blade could often serve either as a projectile tip or as a knife, depending on what it was fastened to. The kind of notches or base is not an indication of whether it was a point or knife, since knives with the handles intact have been found to include a variety of shapes.[51] Careful examination of the edges of the implement itself, however, will often reveal whether it has been worn by cutting or scraping functions. Usable knives could probably not have been made of the very small or slender points, and they may therefore be considered arrowpoints. But no arbitrary size or width limit can be set. The so-called "bird points" of small size and delicate workmanship were doubtless used for shooting a considerable variety of small game besides birds. The idea that they were used as points on blow-gun darts is completely disposed of by Krieger.[52] Careful examination of the Jeddito chipped implements showed that only a few shapes had not been used as knives (see table 15). Among these were the small triangular, side-notched points (both concave and notched bases) and the serrate points. Consequently they may justifiably be called arrowpoints—or, more wisely, projectile points.

The absence of notches or stem on a point not only does not indicate how it was used, but it does not even mean that it was not hafted. Small triangular stemless points would be quite suitable for arrowpoints, and could be easily hafted with gum or other adhesive, as was done, for example, at Kings Ruin.[53]

Atlatl dart points have survived, still hafted, at several dry sites. The points are leaf-shaped, with side notches usually perpendicular to the long axis. Occasionally diagonal notched points were used, with expanding base as wide as the shoulder. But there is no reason to believe that all such points were from atlatl darts, because almost identical points were made long after the atlatl went out of use. It was replaced by the bow at the beginning of Basket Maker III in the San Juan district, and probably not much later than this in other parts of the Southwest. It did persist into historic times in the Southeastern United States, however, as well as in Mexico and the Arctic.

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[49] Browne, 1940, p. 209.

[50] Roberts, 1940, p. 123.

[51] Kidder and Guernsey, 1919, p. 94, pl. 35. Morris, 1919. p. 32, fig. 17. Pepper, 1920, pp. 213, 326, figs. 94, 95, 134, 135.

[52] Krieger, 1945b, p. 47.

[53] Spicer, 1936, p. 51.

The lance, for thrusting, was used by some tribes of the Southwest, including the Hopi, as a weapon.[54] How early it was used in the region cannot be determined, since lances have not been found intact. The points used on them might also have served as knives, so, lacking the perishable parts, distinguishing the two would be difficult, except by wear on the edges which would indicate use as a knife.

Ethnographic data on arrowpoints are more satisfactory. The bow and arrow were important to the Hopi and to other tribes both as a weapon and for hunting. As late as 1840 a "trespassing" Navaho was shot by Oraibis, with bow and arrow.[55] Metal tipped arrows replaced stone, beginning in the 17th century, as indicated by a single copper arrowpoint at Awatovi and the iron and copper arrowpoints at Pecos.[56] But the bow and arrow were far from indispensable in Hopi hunting, since for rabbits the rabbit stick was the preferred weapon and large game was run down on foot and smothered.[57] In spite of the careful descriptions published of hunting practices, we lack a description of the arrowpoints. Such points as are described are generally involved in secondary uses, and may or may not have actually been used on arrows.

Among these secondary uses one of the most important is as a symbol. For example, outside the Hopi Snake kiva, a "standard" which contains two arrows is erected to indicate that ritual activities are in progress.[58] In discussing the points found with burials at Sikyatki Fewkes wrote:

> Arrowheads sewed into a bandoleer are still worn as insignia of rank by warriors, and it is probable that such was also true in the past, so that on interment these arrowpoints might have been placed in the mortuary basin deposited by the side of the warrior, as indicative of his standing or rank, and the bandoleer or leather strap to which they were attached decayed during its long burial in the earth.[59]

The stick of office of the Oraibi War Chief had "twelve flint arrow and spear heads" attached to the upper end,[60] and the Zuñi War Chiefs also had an "arrow-tipped stick or staff."[61] On certain of the "altars," which are simply arrangements of symbolic objects associated with particular ceremonies, the Hopi and the other Pueblos place stone points. The Oraibi Powamu altar includes "four flint spear points,"[62] and there are stone points on the Oraibi Soyal altar of the 4th day.[63] The Zuñi carved animals which often appear on altars usually have stone points fastened to them.[64] These symbolic uses all seem to depend on the association of arrowpoints with war and hunting, and hence with "power." Parsons writes, "A stone point is very generally used in personal protection as charm or amulet,"[65] and cites several instances of such use from Ácoma, Laguna, Isleta, Taos, Sia, Zuñi and San Juan. Also, she writes, "stone points are generally called lightning stones or associated with lighting" (Hopi, Isleta, Zuñi). Figure 25, *t* is a fragmentary point worn very smooth and showing wear from a suspension cord, which may have been worn as a personal charm.

The only two points found *in situ* in Jeddito sites were with burials in the main church at Awatovi. One was on the left arm of a skeleton, the other on the left knee. These were possibly "charms" or were worn as insignia of rank or status, as suggested by Fewkes in the quotation above.

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[54] E. and P. Beaglehole, 1935, p. 19.

[55] Parsons, 1936b, p. 1002, note 1.

[56] Kidder, 1932, p. 306, fig. 250, *c*, *d*, fig. 251, *g*, *i*.

[57] E. Beaglehole, 1936, pp. 6, 13.

[58] Titiev, 1944, p. 143. Dorsey and Voth, 1902, p. 227.

[59] Fewkes, 1898a, p. 731.

[60] Dorsey and Voth, 1901, p. 18, pl. VI.

[61] Parsons, 1939, p. 326.

[62] Voth, 1901, p. 77.

[63] Dorsey and Voth, 1901, p. 22.

[64] Cushing, 1883, *passim*.

[65] Parsons, 1939, p. 332, and also p. 483.

Today such symbolic functions are the only ones remaining for stone points, as metal has long since superseded stone for projectile points.[66]

As knives and scrapers there would have been many practical functions for these chipped points and blades. The possibilities are suggested here, but a complete list of uses would probably be much longer.

1) Skinning and butchering game. Casteñada's famous 16th century description of the Plains Indians vividly suggests the effectiveness of even a small, simple stone tool on a carcass as large as a buffalo. "They cut the hide open at the back and pull it off at the joints, using a flint as large as a finger, tied in a little stick, with as much ease as if working with a good iron tool."[67] For such work almost any but the smallest notched points would serve, as well as many of the flake tools.

2) Dressing hides. The large stemless blades would be the most suitable for this, especially the large asymmetric blades, since they fit the hand comfortably even without a handle. More than half of those from the Jeddito sites showed dulling on one or both edges. Although Hough has expressed a contrary opinion, metal knives would not be necessary for careful and easy working of leather into tailored garments, containers and other equipment.[68]

3) Saws, for use on bone and wood, but probably not on stone. The toothed retouch occasionally given to flakes would greatly increase their cutting power, but most retouched edges have enough irregularity to be used effectively with a sawing motion. Bone tubes and beads often show that they were cut at the ends by means of an encircling groove part way through the bone. Such a groove can be quickly cut in bone with a scrap of flint. The Jeddito sites yielded no distinctly saw toothed flakes of the sort found at Hough's Upper Gila sites and at Fourmile and Chevlon.

4) Scraping and smoothing such small wooden objects as bows, arrowshafts, handles for knives, in the way that we use glass in our modern wood working. Sandstone abraders would generally have served equally well.

A little experimenting with unretouched stone flakes shows that they become dulled rather quickly when used on bone or hard wood, because of the misroscopic flakes removed along the edge even before a smoothed, rounded edge begins to appear. If the edge is one that has been retouched, with the two surfaces meeting at a less acute angle, the dulling is slower, and more of it consists of microscopic polished surfaces truncating the more prominent irregularities. Consequently, unretouched flakes would be used and discarded very rapidly, if an unlimited supply of fresh material were available. At Awatovi there were relatively few blades with no retouch. Since supplies of sandstone were abundant, and chert not available close to the site, scraping and smoothing probably were done with the latter less than with sandstone abraders.

Chipped drills were probably used on wood, horn, shell and bone, but experiments have shown that they are not satisfactory on stone. When a depth of more than about half an inch is reached they snap under the strain.[69] However, most small stone ornaments such as pendants and beads are thin, and often are of soft materials, so that chipped drills might have been used for large holes. No stone drill would be small enough for the holes of small beads and pendants, and a cactus spine has been suggested as the probable tool for this.[70] Whether the stone drills were mounted in wooden shafts or handles is not known, but by analogy with modern practice they probably were. Modern Hopi, Zuñi and other Pueblo craftsmen use the pump drill,[71] translating the vertical motion of a cross bar into rotary motion by means of a spirally wrapped cord around the shaft of the drill. This may be a European innovation, as no pump drills have been found in pre-contact sites, as far as I know. The bow drill, which translates the reciprocal motion of the bow into rotary motion by means of the bow string looped around the shaft, was used in prehistoric times. Drills have been found in dry sites mounted on long slender shafts which might have been turned this way, or perhaps between the palms of the hands.[72] Other drills were probably used in one hand, as they are mounted in short, stout handles which would fit in the palm of the hand.[73] For drilling larger holes, such as the interior of stone pipes, tubular wooden or reed drills were used. The interiors of the Jeddito stone pipes show the marks of these cylindrical drills, which probably depended for cutting on sand and water, rather than the material of the drill itself.

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[66] Hough, 1918, p. 288, mentions the making of metal points.

[67] Winship, 1896, p. 528.

[68] Hough, 1918, p. 280.

[69] McGuire, 1896, p. 681, quoted in Kidder, 1932, p. 27. See also Knoblock, 1939, for drilling experiments.

[70] Hough, 1914, p. 23; also Haury, 1931a.

[71] Hough, 1918, p. 276, fig. 42 (Hopi); J. Stevenson, 1884, p. 42 (Zuñi); Gifford, 1940, p. 27, item 976 (Santa Ana and San Ildefonso).

EVIDENCE OF WEAR ON THE EDGES OF CHIPPED STONE TOOLS

As an aid to deciding which of the points and blades in this collection might have been used as knives or scrapers, each one was carefully examined for evidence of wear along its edges. On some there was no trace of wear or smoothing, but on a considerable number either one or both edges were dulled as though from use for cutting. Examination under a 10-power hand lens showed that the dulling generally consisted of a series of smooth surfaces worn on the projections along the edge, with no striations visible to indicate if the wear had been by a cutting or scraping motion. Presumably the materials cut were not hard enough to leave striations, although hard enough to dull the chipped edges. It seems doubtful if an implement used only as a projectile point would ever be dulled in this way. However, many of the tools used for cutting and scraping may formerly have been used on projectiles. It cannot be too often stressed that most of the tools of the Indians of the Southwest were put to a multiplicity of uses.

Table 15 summarizes the observations made on the Jeddito chipped tools, indicating the percentage of each shape that had worn edges. Only a few types were used exclusively as projectile points, to judge from these observations. These include the Side Notched Concave Based and Notched Base Points, which would have been too small to serve as knives anyway. Also, serrate points and stemless blades with pointed base show no wear on their edges. With such small numbers as are available in some shapes, the observations must be considered only suggestive. But similar examination of blades and points from other sites ought to be a regular part of field or laboratory studies, to provide a proper basis for opinions as to the former functions of these implements.

TABLE 15: Percentage of Blades and Points of Each Major Shape Showing Wear on One or Both Edges

Major Shapes	Per Cent
Stemless Blades	
Asymmetric	54
Symmetric, pointed base	0
Symmetric, round base	42
Symmetric, large, straight base	48
Symmetric, small, straight base	7
Large fragments, probably stemless	32
Side Notched Points	
Straight based (stem wider than shoulder)	6
Concave based (stem wider than shoulder)	0
Notched based (stem wider than shoulder)	0
Stem narrower than shoulder, wide based	34
Stem narrower than shoulder, narrow based	5
Diagonal Notched Points	
Slender, barbed	25
Broad, shouldered or barbed	27
Tapered stemmed	43
Serrate Points	0
Fragments, unclassified	19
Average	22

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[72] For example, at Betatakin, Judd, 1930, pp. 60–61, fig. 17, *a*, *b*.

[73] For example, Guernsey and Kidder, 1921, p. 95, pl. 35, *e*.

ORNAMENTS

GENERAL REMARKS

Various objects classed as ornaments include pendants, beads and rings, numerous small unperforated objects of which some may be unfinished pendants, and a quantity of mica objects most of which came from Church 2. The distinction between beads and pendants follows the arbitrary but convenient suggestion of Kidder: in beads the perforation is centrally located, in pendants near the edge.[1] Most of the beads are small, but a few are large enough to make their use as single pendants possible.

Although ornaments of any kind are relatively rare in the Jeddito sites, their lack of standardization makes it necessary to describe them almost one by one. They may have played a minor part in the lives of the Indians, but some of them may be of significant rare shapes and hence serve as clues to cultural relationships with other areas. Little has been done so far in analyzing distributions of these minor artifacts, and a necessary preliminary will be the publishing of fairly full descriptive data.

Materials of Jeddito ornaments include turquoise and red shale or argillite, neither of them obtainable locally. Several other fine-grained stones were used, shales, limestone and slates whose sources are unknown. Objects of selenite are not numerous, and are mostly crude, in spite of the ease with which such soft material can be worked.

PENDANTS

Zoomorphic. Figure 29, *z* is the only zoomorphic pendant found. It is red argillite, the surface poorly finished with marks of cutting and grinding visible, but smoothed and stained as though by much handling. It is made from a flat piece of stone, the legs shown merely by notches and slight grooving longitudinally. The head lacks any attempt to show features, and the tail is equally crude. Length 4.0 centimeters. Awatovi, Pueblo V.

Rectangular, perforated at end. Three of red argillite, figure 29, *a–c*. Sides slightly convex; length approximately 3 centimeters. One has two holes, both biconical; the others have a single conical hole. Awatovi, Pueblo V (2) and Unassigned (1).

One of selenite, figure 31, *b*. Crudely shaped with rough edges, the faces natural cleavage surfaces. Length 2.2 centimeters, Awatovi Pueblo IV.

One of fine-grained gray stone, fragmentary, with two holes at the end. Surface highly polished, edges squared with three tiny notches in end. Awatovi Unassigned.

Three of turquoise, subrectangular to ovoid. Figure 32, *r*, *u* are small with edges squared, lengths 0.8 and 0.9 centimeters, both of greenish turquoise, Awatovi Pueblo V. Figure 32, *s* of blue material with matrix veins running through it, highly polished and rounded; length 1.2 centimeters, Awatovi Pueblo V.

One of black shale, figure 29, *v*, edges rough, faces deeply scarred as though to reduce its thickness further, biconical hole, length 3.3 centimeters, Awatovi Pueblo V.

Rectangular, perforated at side. Three of red argillite, figure 29, *d*, *e*, *g*, length 1.7 to 3.2 centimeters, Awatovi Pueblo III and IV, and Site 4A Pueblo II.

One of turquoise, figure 32, *v*, one face well smoothed with slightly bevelled edges, length 1.0 centimeters, Site 264 Basket Maker III-Pueblo I.

Trapezoidal. Two of red argillite: figure 29, *j*, poorly finished, hole in small end, length 2.2 centimeters, Awatovi Pueblo V. Figure 29, *h*, faces ground but not polished, hole in large end, length 2.4 centimeters, Awatovi Pueblo IV.

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[1] Kidder, 1932, p. 184, note 2.

Two of turquoise: figure 32, *t*, very bright blue, highly polished, length 1.5 centimeters, Kawaika-a Pueblo III-IV. Figure 32, *q* of poor quality, end broken through original hole and second hole drilled just below, surface smoothed by much handling, length 1.0 centimeter, Awatovi, P IV.

One of fine gray sandstone, figure 29, *i*, carefully made and smoothed, length 2.2 centimeters, Awatovi Unassigned.

One of fine-grained light green stone, probably not turquoise, fragment probably had two holes at small end, original length about 3 centimeters, Awatovi Pueblo IV.

One of selenite, figure 31, *c*, poorly made, edges rough, length 2.7 centimeters, Awatovi Pueblo IV.

Round or Oval. Two of red argillite: figure 29, *k*, fragment with one hole at edge remaining, originally about 3.5 centimeters in diameter, well polished, Awatovi Pueblo III. Figure 29, *f*, fragment, hole may be nearly at center, polished, originally about 2 centimeters in diameter, Chakpahu Pueblo III-IV.

Four of turquoise, fragments 1 centimeter or less in length, polished, probably oval, Awatovi Pueblo IV, V (2) and Unassigned.

One of micaceous shale, figure 31, *g*, fragment with single hole remaining, unpolished, width now 2.4 centimeters, Site 14 Pueblo II.

One of dark gray stone (shale ?), figure 29, *m*, fragment much smoothed, suspension hole worn by cord, Awatovi Pueblo IV.

Ovoid. One of red argillite, figure 29, *l*, edges rough but faces well smoothed, conical hole, length 2.2 centimeters, Awatovi Pueblo IV.

One of white limestone, figure 31, *h*, apparently unfinished, surfaces rough, hole gouged rather than drilled, length 3.5 centimeters, Site 14 Pueblo II.

One of turquoise or malachite, ground flat but not polished, conical hole, length 1.3 centimeters, Awatovi Pueblo V.

Cruciform. Three of red argillite, figure 29, *n*, *o*, *p*, of a shape made by cutting out the corners of a rectangle (here called "cruciform"), hole near long side, length 2.8 to 1.4 centimeters, Site 108 Pueblo II-III, Pink Arrow and Kokopnyama Pueblo III-IV.

One of gray limestone, figure 29, *q*, fragmentary, one part light gray, other smoke blackened or burned, surface polished, hole near long edge with only trace remaining, length 6.0 centimeters, Pink Arrow Pueblo III-IV.

Other Shapes. One of lignite (?), figure 29, *b'*, fragments with one edge and face highly polished, biconical hole, present length 4.0 centimeters, Awatovi Pueblo V.

Two of turquoise: one bright blue fragment, may have been lozenge-shaped originally, has single hole, length 0.8 centimeter, Awatovi Pueblo IV. One dull green fragment, may have been trapezoidal, traces of two holes, Awatovi Pueblo V.

Eight of selenite: three irregular pieces with a hole at each end, others with single hole, as in figure 31, *d*. Some of these holes gouged, some drilled. Length 4 to 10 centimeters, thickness 0.1 to 0.6 centimeter. None appear intentionally shaped, and straight edges are due to natural cleavage. Awatovi Pueblo IV (2), Pueblo V (3), Unassigned (2). Figure 31, *a*,

TABLE 16: Shape and Material of Jeddito Pendants

	Turquoise	Red Argillite	Selenite	Unknown or Misc.	Total
Zoomorphic	—	1	—	—	1
Rectangular					
Perf. at end	3	3	1	2	9
Perf. at side	1	3	—	—	4
Trapezoidal	2	2	1	2	7
Round or Oval	4	2	—	2	8
Ovoid	1	1	—	1	3
Cruciform	—	3	—	1	4
Irregular and Misc.	2	—	8	3	13
Total	13	15	10	11	49

has crude incised decoration on it, very faint, suggestive of a quadruped, two men, a large arrow, and three groups of joined squares resembling a floor plan or schematic view of a pueblo, from Awatovi Pueblo V.

One of dark gray stone (slate ?), figure 29, *d'*, shaped like a slender plumb-bob with blunt point, grooved just below the biconical hole, length 7.6 centimeters, Pink Arrow Pueblo III-IV.

One of green stone (serpentine ?), figure 29, *w*, tabular with one convex and one concave edge, traces of sawing and breaking along the latter, polished all over, length 3.5 centimeters, Awatovi Pueblo V.

Summary of Material. See table 16. Turquoise is rare in the Jeddito sites, although a few fragments of inlay or mosaic were found, besides the pendants just listed. There is a possibility that some of the turquoise found by the Indian workmen might have been kept by them, since this is still a valued material, a medium of exchange and of personal adornment.[2] The amount lost in this way was probably negligible, since in the considerable amount of digging done personally by staff members turquoise was equally scarce. Its rarity in the Jeddito district may have been due to the lack of supplies even within the radius of a few days' travel. Possible sources will be discussed later.

Red argillite is a very fine-grained red shale used quite widely in the Southwest for small ornaments. It is similar to the catlinite or pipestone of Minnesota, but of slightly different chemical composition. Probable sources in the Southwest are discussed below.

Selenite is a crystalline form of gypsum, characterized by cleavage primarily in one plane, producing thin sheets. There is a secondary cleavage along two planes intersecting at 66° and 114° so that geometric shapes such as lozenges are produced naturally. Although soft and hence easily cut, selenite cannot be polished, and is fragile, so that the only pendants made of it were rather crude. Selenite may have been obtained in the Hopi Buttes within 10 or 15 miles of Awatovi, to the South.[3]

Summary of Provenience.

Site 264, BM III-early P I		1
Site 4A, P I-II		1
Site 14, P II		2
Site 108, P II-III		1
Pink Arrow, P III-IV		3
Awatovi,	P III (W-O)	1
"	P III (B/O)	1
"	P IV (O-Y)	1
"	P IV (B/Y)	6
"	P IV (Y-17)	5
"	P V (17c)	18
"	Unassigned	6
Kawaika-a, P III-IV		1
Chakpahu, P III-IV		1
Kokopnyama, P III-IV		1
Total		49

BEADS

Description. All are thin disks with a single central hole. Four of turquoise: figure 32, *m*, green, much worn and slightly convex on both faces, diameter 0.9 centimeter, thickness 0.2 centimeter, Awatovi Unassigned. One of bright blue, well polished, cylindrical hole, diameter 0.35 centimeter, Awatovi Pueblo IV. One identical with the preceding, bright blue, found on floor of Test 31, Room 1 (a kiva), Awatovi Pueblo V. One fragment, bright blue, polished, diameter 0.3 centimeter, Awatovi Unassigned.

One of red argillite, figure 29, *u*, edge smoothed but faces irregular, diameter 1.5 centimeters, thickness 0.1 centimeter, Awatovi Pueblo IV.

One of fossil crinoid stem, figure 31, *j*, encircled by two natural grooves, hole possibly natural, somewhat smoothed by wear, Awatovi Unassigned.

Two of light gray stone: One ground smooth, unpolished, diameter 0.6 centimeter, thickness 0.2 centimeter, Awatovi Unassigned. One with only one surface smoothed, perhaps split, diameter 0.4 centimeter, thickness 0.1 centimeter, Site 263, Pueblo I-II.

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[2] Fewkes wrote of Sikyatki: "The Indians faithfully delivered to me all objects which they found in their digging, with the exception of turquoises, many of which, I have reason to suspect, they concealed while our backs were turned and, in a few cases, even before our eyes." (1898a, p. 641)

[3] Hack, 1942c.

Figure 32, *k*, is a string of 4200 to 4300 minute gray stone beads, found with a burial exposed by erosion at Site 241, an unexcavated Pueblo III village 5 miles from Awatovi. The original manner of stringing the beads is uncertain, as they were found scattered, but they appeared to have been around the right arm. As strung at present they are 227 centimeters long. Diameter is very uniform, 0.15 centimeter, thickness more variable with about 19 beads to the centimeter. About one-quarter are of a darker gray stone than the others.

Summary of Provenience.

Site 241,	P III	1 (string)
Site 263,	P I-II	1
Awatovi,	P IV (B/Y)	2
”	P V (17c)	1
”	Unassigned	4
Total		9

RINGS

Figure 29, *x*, of dark brown stone, 1.9 centimeters outside diameter, 1.1 centimeters wide. Interior drilled from both sides, biconical hole only 1.2 centimeters in diameter at center. Exterior ground down, faceted, partly smoothed and polished. Site 111, Pueblo II. (This ring is extremely small to have been worn on a finger, but the smoothing suggests that it may have been.)

Figure 29, *y*, of red argillite, 2.0 centimeters, outside diameter, 1.6 centimeters inside diameter, 0.7 centimeter wide. Carefully smoothed, all marks of drilling or grinding removed. Awatovi Pueblo IV.

Provenience.	Site 111, P II	1
	Awatovi, P IV (B/Y)	1
	Total	2

MICA OBJECTS

Figure 30.

Various geometric shapes were cut out of white mica, of a silvery, translucent type. There are a slender lozenge, a rectangle, a triangle, two disks and several teardrop shapes, besides numerous fragments too small for the original shape to be evident. Lengths are from 2 to 3 centimeters. Several small scraps have a thin white layer of plaster adhering to them, with tiny bits of wood imbedded in it. Consequently they may have been applied to wooden objects as ornaments. Most of the shaped pieces and about 40 fragments are from the floor of Church 2 of the Mission, near the foot of the steps to the altar. This is where Montgomery postulates that the communion rail would have stood, although neither the rail itself nor sockets for its supports were found in the excavation of the church.[4] There were 16 fragments on the uppermost floor (No. 1) of Room 451, which had served as the vesting sacristy of the main church, but later was occupied by Hopis. Fragments, most of them from small geometric shapes, came from five other 17th century rooms, of which two were Friary rooms used by the Indians after the friars left the mission. Since no mica was found in any part of the site except the mission and adjoining Hopi rooms, it may well be that it was all brought to Awatovi by the Spanish to be used as ornament on ecclesiastical equipment. If so, it would have found its way into Hopi houses along with other church loot after the Revolt of 1680. The pieces of mica were distributed in the site as follows:

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[4] Montgomery, Smith and Brew, 1949, p. 65, and fig. 40.

Awatovi, Church and Friary:	32 shaped (whole or fragments)
" Church and Friary:	61 unshaped
" Hopi rooms:	26 shaped (whole or fragments)
" Hopi rooms:	10 unshaped
Total	129

UNPERFORATED ORNAMENTS

Some of these specimens may be unfinished pendants, others may have served as ornaments or for purposes unknown.

Turquoise Mosaic and Inlay. Figure 32, *h*, is a fragment of mosaic, the only such work found in the Jeddito excavations. It comes from the Pueblo IV (Y-17) rubbish fill of a kiva, Test 57, Room 1, 50-100 centimeter level. Since it was found unexpectedly and disturbed in exposing it, there may have been more pieces than were actually recovered by screening the surrounding earth. There are 13 tiny pieces of turquoise, mounted on what appears to have been a piece of reed or cane about 2 centimeters long and 1 centimeter wide. The bits of turquoise are roughly rectangular, polished on one face.

Twelve more small bits of turquoise found at Awatovi were smoothed on one or both faces, partly squared at the edges, as though for use in mosaic or inlay. They were all found singly, however, on the surface or in rubbish. One was found in the fill of a Pueblo III (B/W) room, others from Pueblo IV and V. One was imbedded in the wall plaster of a corridor in the Friary, probably accidentally included in the abobe. Three pieces had small depressions drilled in them, as though a suspension hole had been begun but never finished. Their lengths range from 0.6 to 0.3 centimeters.

At Site 264 (Basket Maker III-early Pueblo I), there were found three small pieces of green stone resembling a poor grade turquoise. One was in the fill of Room 8, the other two in Room 16, one on the floor and one on the lower bench, both at the west side of the room. Lacking perforations, they were similar in size to turquoises for inlay, and may have been so intended.

Trapezoidal. One of turquoise, figure 32, *p*, a fragment which may have been trapezoidal, one surface polished, other rough and dull, length 1.3 centimeters, Awatovi Pueblo V.

Two of red argillite: figure 29, *t*, much worn as though by handling, length 2.0 centimeters. Figure 29, *r*, partly smoothed but with rough edges. Both Awatovi surface finds. May be unfinished pendants.

Disks. Three of red argillite: Two are small fragments of disks originally 3 to 4 centimeters in diameter, well polished, Pink Arrow Pueblo III-IV and Awatovi Pueblo III. One is a fragment partly ground to shape, Awatovi Pueblo V.

One of turquoise, figure 32, *o*, fragment, well polished, 1.8 centimeters long and 0.4 centimeter thick, Awatovi Pueblo V.

Five of white limestone: figure 31, *o*, the largest, fragmentary, has four groups of four notches each around the edge, diameter 9.2 centimeters, Awatovi Pueblo IV. Figure 31, *l*, the smallest, has the edge of one face decorated with small incisions like a dismembered zigzag, diameter 4.3 centimeters, Awatovi Pueblo V. Three other fragments are similar, fragile disks ground smooth with rounded edges, Pink Arrow Pueblo III-IV, and Awatovi Pueblo IV and V.

Three of selenite, crudely-made disks, edges partly smoothed, faces natural cleavage surfaces, diameters 2.5 to 5.2 centimeters, Awatovi Pueblo IV (1) and V (2).

Rectangular. Three of red argillite: figure 29, *a'*, unfinished perforation at end, edges ground, faces still rough, length 4.3 centimeters, Awatovi Pueblo IV. Figure 29, *s*, ground smooth, length 2.3 centimeters, Awatovi surface find. Small polished fragment, probably rectangular, polished, from Site 104 Pueblo II-III.

Two of white limestone (?): a rectangle with one face polished and edges squared, of a white laminated material resembling hornstone, 3.9 centimeters long, Awatovi Pueblo

IV. Fragment of soft cream-colored stone, both faces ground smooth, edge squared, length 2.4 centimeters, Awatovi Pueblo V.

Shouldered. Figure 31, *m*, of hard white limestone (?), lenticular cross-section, straight edges tapered toward shouldered narrow end, other end missing, length 2.9 centimeters, Site 104 Pueblo II-III.

Figure 29, *c'*, of spotted gray slate like the material reported by Morris[5] as coming from Mitten Rock in the northwest corner of New Mexico and occasionally used for tcamahias. Faces ground smooth and flat, edges squared, one end shouldered, other missing. Small closely spaced incisions across long edges, Awatovi Pueblo V.

Ellipsoid. Figure 31, *e*, small slender object of fine white sandstone or tuff, edges rounded, ends nearly flat, faces flat, carefully smoothed all over. Shape similar to "atlatl weights" found in Marsh Pass[6] Basket Maker sites. Awatovi Pueblo IV.

TABLE 17: Shape and Material of Unperforated Ornaments

	Turquoise	Red Argillite	Limestone	Selenite	Misc. or Unknown	Total
Mosaic or inlay fragments	16	—	—	—	—	16
Trapezoids	1	2	—	—	—	3
Disks	1	3	5	3	—	12
Rectangles	—	3	2	—	—	5
Shouldered	—	—	1	—	1	2
Ellipsoid	—	—	—	—	1	1
Spatulate	—	—	1	1	2	4
Other shapes	5	1	1	2	3	12
Total	23	9	10	6	7	55

Spatulate. Figure 31, *f*, of chert or milky quartz, polished, one end missing, length 2.4 centimeters, Awatovi Unassigned.

Figure 31, *k*, similar to preceding, highly polished, length 3.0 centimeters, Awatovi Pueblo V.

Figure 31, *n*, of selenite, edges cut and partly ground smooth, faces natural cleavage planes, length 6.9 centimeters, Awatovi Pueblo IV.

Figure 31, *p*, creamy white sandy limestone, fragment with one end missing, edges and faces smoothed, length 4.9 centimeters, Site 264 on bench on northwest side of Room 16, Basket Maker III-early P I.

Other Shapes. Figure 31, *i*, soft white translucent material, hook-shaped object with curved section rising from a flat basal portion, unfinished hole through thin end of basal portion, end of curved section wedge-shaped. Size 1.8 by 1.5 by 0.8 centimeters, Site 111 Pueblo II.

Figure 28, *j*, obsidian, ground on faces and edges but several flake scars still show, length 2.8 centimeters, Awatovi Pueblo V.

Figure 28, *k*, fine gray sandstone or tuff, triangular cross-section, small end pointed, other bevelled, carefully ground on all four faces, length 3.7 centimeters, Awatovi Pueblo IV.

Figure 28, *l*, piece of concretionary sandstone, ground smooth on faces, possibly of natural shape, very hard and yellow-brown, length 3.4 centimeters, Site 231 Pueblo III.

Crescentic object of laminated gray and brown stone, possibly naturally produced by weathering, and picked up by an Indian as a curiosity, length 3.2 centimeters, Awatovi Unassigned.

Red argillite fragment, trapezoidal or rectangular with five notches in extant end, Awatovi Pueblo IV.

Two irregular pieces of selenite, crudely cut and ground; one roughly heart-shaped, 3.4 centimeters long, the other elongated with a narrow encircling groove, 2.9 centimeters long. Both Awatovi Pueblo V.

Five small fragments of turquoise: figure 32, *l*, is bright blue, highly polished, with two small notches by which a cord could have been held in place, Awatovi Pueblo V. A similar triangular bright blue fragment was found on the floor of Room 788 in front of the ventilator shaft; this is the kiva filled up in the 17th century in order to build the altar of Church 2 above it. Three other fragments are all pale green, one with an unfinished hole in the smoother surface, Awatovi Pueblo IV (2) and Unassigned (1).

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[5] Morris, 1939, p. 139.

[6] Kidder and Guernsey, 1919, p. 83.

Material. See table 17.

Provenience and Total. See table 18.

TABLE 18: Provenience of Unperforated Ornaments

	Mosaic fgts.	Trapezoids	Disks	Rectangles	Shouldered	Ellipsoid	Spatulate	Other Shapes	Total
Site 264, BM III-early P I	3	—	—	—	—	—	1	—	4
Site 111, P II	—	—	—	—	—	—	—	1	1
Site 104, P II-III	—	—	—	1	1	—	—	—	2
Site 231, P III	—	—	—	—	—	—	—	1	1
Pink Arrow, P III-IV	—	—	2	—	—	—	—	—	2
Awatovi, P III (B/W)	1	—	1	—	—	—	—	—	2
" P IV (O-Y)	—	—	—	1	—	—	—	1	2
" P IV (B/Y)	1	—	2	1	—	1	—	—	5
" P IV (Y-17)	1	—	2	—	—	—	1	3	7
" P V (17c)	4	1	5	1	1	—	1	5	18
" Unassigned	6	2	—	1	—	—	1	1	11
Total	16	3	12	5	2	1	4	12	55

DISCUSSION OF ORNAMENTS

Pendants of simple shapes, cut out of various stone materials and perforated for suspension, date back to Basket Maker III in the Pueblo area. Generally speaking, they seem to be more abundant at sites where shell is scarce, probably because stone was a less convenient material to work into ornaments, and was not much used if shell was available. The commonest pendant shapes are rectangular or subrectangular, round or oval and trapezoidal. All three are reported from Basket Maker III. In the Rio Grande, Mesa Verde and La Plata districts such pendants were rare, although not entirely absent.

In the Jeddito district no trapezoidal pendants appear until early Pueblo IV (Awatovi O-Y), and only a few pendants of the other shapes occur before this.

A distinctive shape of very limited occurrence is the one I have called "cruciform." Only four were found in Jeddito sites, all in Pueblo III and IV horizons. Rinaldo suggests that this is a conventionalized "thunderbird" and reports that there are specimens in museum collections from Pueblo Bonito (National Museum), Gila Pueblo (Arizona State Museum), Puye (Museum of New Mexico) and Kokopnyama (Museum of Northern Arizona).[7]

There is another Kokopnyama pendant of this shape, of red argillite, unfinished, in the United States National Museum,[8] and one was found in "Ruin A" in Marsh Pass, Kayenta district, probably of Pueblo III date.[9] One of the gypsum pendants at Kinishba is suggestive of this shape, but too fragmentary to be positively so.[10] Because of the distinctive shape and the small number of examples known, these cruciform pendants may be the product of a single locality.

The only zoomorphic pendant found in the Jeddito sites is from 17th century Awatovi. Its form is vaguely similar to the larger carved quadrupeds described below, identified as mountain lions. But the pendant appears to have a projecting tail, rather than the recurved tail of the mountain lions. At Zuñi, Cushing found this extended tail to be characteristic of the small stone coyotes and wild cats.[11] Pendants in animal form are more common in the Hohokam culture than in the Pueblo, and are most often in the form of birds. Zoomorphic pendants have been reported from the following places where they may be the result of Hohokam influence:

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[7] Rinaldo, 1941a, pp. 130–133.

[8] No. 350 233, collected by National Geographical Society.

[9] Kidder and Guernsey, 1919, p. 127, fig. 50.

[10] Cummings, 1940, p. 58.

Angell and Winona Foci (McGregor, 1941, p. 202, fig. 69)
Woodruff Butte (Fewkes, 1904, p. 135, fig. 85)
Spur Ranch (Hough, 1914, p. 27)
Kawaika-a (Hough, 1903, p. 344, pl. 96, no. 6)

The long plummet-like pendant found at Pink Arrow (fig. 29, *d'*) is nearly duplicated at Pinedale[12] and at Winona Village.[13]

No consistent association of shape and material appears in pendants of the Jeddito district, or in the Southwest in general. The choice of material probably depends considerably on available local supplies, while cultural traditions would dictate the shapes made.

Unperforated ornaments include, in the Jeddito collections, several objects which in shape and size are indistinguishable from pendants, but lack perforations. They are rectangular, round, oval and trapezoidal, and probably are unfinished pendants.

There are two small shouldered objects, one of slate and one of limestone (?). I know of no similar objects elsewhere and can suggest no use for them. Several other small pieces of stone that are carefully worked to distinctive shapes also have no known functions. They might have served as symbolic paraphernalia on altars, as charms or "medicine" in rituals, but there is no concrete evidence for any such use.

Mosaic decoration at Awatovi consisted of a single fragmentary piece of wood or reed with small rectangles of turquoise, and a dozen more single pieces of turquoise found in other parts of the site. Also, there was a fine example of inlay on bone that will be described in a later report but deserves mention here. A bone awl found at Site 111 (Pueblo II), made of the metapodiale of a deer or antelope, had the butt carved to represent a mountain sheep, or possibly a dog. Two tiny irregular bits of turquoise were set into the eyes. This is one of the earliest reported examples of turquoise inlay in the Pueblo area. The three small pieces of turquoise or malachite at Site 264 seem suitable for no other purpose than inlay work. The technic may have already been known in Basket Maker III-Pueblo I times, as pieces of turquoise for mosaic or inlay were found at Shabik'eschee, a Basket Maker III site in Chaco Canyon.[14] Both mosaic and inlay with turquoise have been found fairly commonly in northern Arizona in Pueblo II and III sites. This is the periphery of a decorative technic that was important in Mexico and Central America, whence it probably spread to the Southwest. Haury suggests a date "before 700 A.D." for the introduction in southern Arizona of the Central American disks with iron pyrites mosaic (sometimes called "mirrors"). They are not known further north, but the related technics of mosaic and inlay occur widely in the Pueblo area as indicated by the following list:

El Paso area, undated caves (Roberts, 1929a, p. 13, pl. 5)
RB 568, Kayenta district Pueblo III (Beals, Brainerd and Smith, 1945, p. 76)
Poncho House, Southeast Utah Pueblo II-III (Guernsey, 1931, p. 103, frontispiece and pl. 24)
La Plata district "Holmes Group" and Site 41, Pueblo III (Morris, 1939, p. 141, figs. 174, *b* and 178, *g*, *h*)
Pueblo Bonito Pueblo III (Pepper, 1920, pp. 63, 71, 79, 90, 135, 158, 164, 205, fig. 50, and Pepper, 1905)
Chevlon, Little Colorado Pueblo IV (Fewkes, 1904, p. 86, fig. 42)
Chavez Pass, Little Colorado Pueblo IV (Fewkes, 1904, p. 86, fig. 44)
Wukoki, Little Colorado Pueblo III (Fewkes, 1926, p. 104, fig. 105, *c*)
Tuzigoot, Verde Valley Pueblo III-IV (Caywood and Spicer, 1935, pp. 87–89, pl. xvii)
Ridge Ruin, Flagstaff Pueblo III (McGregor, 1943, p. 288, pl. I-II)
Stone Axe Ruin, Little Colorado Pueblo IV (Hough, 1903, p. 321)
King's Ruin, Verde Valley Pueblo III (Spicer, 1936, p. 67 (pl. xxix-xxx)
Pecos, Pueblo IV-V (Kidder, 1932, pp. 101–104, fig. 78)
Aztec, Pueblo III (Morris, 1919, p. 100, fig. 73)
Hawikuh, Pueblo IV-V (Hodge, 1921, 1922)

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[11] Cushing, 1883, pp. 26–27.

[12] Haury, 1931b, p. 54, fig. 13, *p*.

[13] McGregor, 1941, p. 201, fig. 69, C.

[14] Roberts, 1929b, p. 142, pl. 30.

Kinishba, Pueblo III-IV (Cummings, 1940, p. 60)
Swarts Ruin, Classic Mimbres (Cosgrove, 1932, p. 65)

In the Hohokam area turquoise mosaic is present at such Classic Period sites as Casa Grande and Los Muertos, where Pueblo influence might be expected to account for it.[15] At Snaketown a few pieces of turquoise probably used in mosaic or inlay came from various levels, from the Pioneer Period onward,[16] approximately contemporary with Basket Maker III.

Beads are extremely rare in the Jeddito sites. They are disk shaped, of turquoise and fine gray stone and one is of red argillite. The turquoise beads are 0.35 and 0.9 centimeter in diameter and come from Awatovi Pueblo IV and V. The single large group of minute gray stone beads is from a Pueblo III burial. They average about 48 to the inch (19 per centimeter), which is comparable to the beads from Pueblo III sites in the Kayenta area: RB 568 (30 to 35 per inch),[17] Kaycuddy Wash (40 per inch),[18] Nitsie Canyon (60 per inch),[19] and Adugegi Canyon (46 per inch).[20] Similar minute stone beads have been found in Pueblo III sites in the La Plata district.[21] All these finds are with burials. Haury concludes, from his study of such beads, that they were made in the Gila-Salt region, for two reasons. First, such beads are most plentiful at Casa Grande, and second, the only device known that could drill such a tiny hole is the spine of the saguaro or of the barrel cactus of southern Arizona.[22] It is, therefore, probable that the string of beads from Site 241 was obtained by trade from the south. Such beads were no longer made in Pueblo IV and V times, were not available to the Pueblos, or were not wanted. Larger disk beads continued to be used up to the present, but they do not exhibit the extreme skill and patience that were necessary for manufacturing the smaller beads.

Stone rings, which may have been worn on fingers, were found at Jeddito Site 111 (Pueblo II) and Awatovi Pueblo IV (B/Y). Except for Lowry Ruin in southwest Colorado,[23] and RB 1006,[24] Kayenta area, such rings have been reported only from sites further south, where they are believed to imitate shell rings: Pinedale,[25] Winona,[26] and Snaketown[27] and later Hohokam sites.

SOURCES OF TURQUOISE

Awatovi is about equidistant from the famous Cerrillos turquoise mines near Santa Fe and the turquoise mines at Mineral Park and Eldorado between Kingman and Boulder Dam. The mine 130 miles to the south on the Salt River at the mouth of Canyon Creek is only a little nearer. Other sources of Southwestern turquoise are even more distant—La Jara, in south central Colorado, Playas Lake and the Burro and Hachita Mountains in southwest New Mexico, Orogrande in south central New Mexico, the Dragoon Mountains of southeast Arizona, and a zone including at least half a dozen mines extending for 200 miles west from Mineral Park, Arizona, across the southern tip of Nevada almost to the Mohave Desert.[28]

There is little likelihood of other important sources having been worked in the past and now forgotten, because the current commercial value of turquoise makes every potential source a matter of local interest and investigation. There are no systematic published descriptions of the distinctive features of the turquoise from the different aboriginal mines, so that the Jeddito material cannot be assigned a source in that way. In fact, several of the more careful descriptions of the mines suggest that a great variety of colors and textures come from a single mine, so that identification of sources might be very hard. The turquoise of the La Jara mines is described as "robin's egg blue with spots of peacock blue."[29] The Dragoon Mountains material "is of a pale blue color due to its low copper content," and more brilliant stones found nearby are believed to have been imported from elsewhere.[30] The Cerrillos turquoise, at its best, is a clear bright blue, but there are great quantities of inferior material at the locality.[31] This was probably much the largest aboriginal turquoise mine, and may have supplied much of the Pueblo area. Demand for turquoise was sufficiently great, however, for the Pueblo Indians to establish large camps around the turquoise mines of California, and at least one permanent village, on the shore of East Cronise Lake in the Mohave Sink Region. At least one sherd of "Hopi ware (Jeddito yellow)"[32] came from a nearby camp site. This suggests that trade existed with the Hopi area, and consequently some of the Hopi turquoise may have come from the mines in the vicinity. According to Rogers, the Mohave Indians are the most probable intermediaries of this trade, but it is even possible that the far travelling Hopis may have visited the area themselves.

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[15] Fewkes, 1912, p. 131. Gladwin, 1928, p. 30. Haury, 1945a, p. 156.

[16] Haury, 1937b, p. 127, pl. CVIII, *a*.

[17] Beals, Brainerd and Smith, 1945, p. 76, pl. 13, *a*.

[18] Haury, 1931a, pp. 81–82, pl. 8.

[19] Haury, 1931a.

[20] Guernsey, 1931, p. 103.

[21] Morris, 1939, p. 141, pl. 175.

[22] Haury, 1931a.

[23] Martin, Roys and von Bonin, 1936, p. 60, fig. 10, *f*.

[24] Beals, Brainerd and Smith, 1945, p. 41.

[25] Haury, 1931b, p. 54, fig. 13, *q*.

[26] McGregor, 1941, p. 204, fig. 70.

[27] Haury, 1937b, p. 128, pl. CVIII, *b*.

[28] Bartlett, 1935 has the fullest discussion of turquoise sources, but I have also drawn on Northrop, 1942, Harrington, 1939, Heiser and Treganza, 1944, Rogers, 1929 and Haury, 1934.

SOURCES OF RED ARGILLITE

It has been proved conclusively by spectroscopic analysis that the red argillite of the Southwest is distinct from the catlinite of Minnesota, in spite of their close similarity in appearance and mineralogical composition.[33] The only mines or quarries of red argillite reported in the Southwest are near Del Rio, north of Prescott,[34] where the material occurs in thin sheets in the pre-Cambrian Mazatzal quartzite. The Del Rio argillite is dark red, with small whitish inclusions visible to the naked eye. Visual comparison of the Awatovi red shale artifacts with samples from the Del Rio quarry[35] indicates that some other source or sources are probable for the Awatovi material. The only artifact with the characteristic appearance of the Del Rio argillite was a tubular pipe, figure 36, *e*, from 17th century Awatovi. The other Jeddito examples lack any inclusions, with the exception of figure 29, *s*, which is thickly flecked with small inclusions which are smaller, closer spaced, more angular and whiter than the inclusions in the Del Rio material examined.

Sources of red argillite might occur wherever the Mazatzal quartzite outcrops throughout the central mountainous portion of Arizona. There might be sources near Tuba City and Ft. Defiance, although it is not known whether there are aboriginal quarries at these exposures. In Howell's spectroscopic analysis, cited above, he found evidence for sources other than the Del Rio quarry, since some of the samples from museum collections were different from both the Del Rio and the Minnesota materials. Besides the red shale or argillite of pre-Cambrian age, a similar but more fragile material has been reported as occurring in the Mancos shale, a much younger geological formation. It outcrops widely throughout northern Arizona, and just south of Marsh Pass includes a red or orange stone of fine texture from which were made the pendants found at Site RB 551.[36]

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[29] Jeançon, 1922, p. 28.

[30] Fulton and Tuthill, 1940, p. 36.

[31] Bandelier, 1892, p. 93.

[32] Rogers, 1929, p. 10, pl. III, 8.

[33] Howell, 1940.

[34] Bartlett, 1939.

[35] Supplied by the Museum of Northern Arizona through the courtesy of Dr. H. S. Colton.

[36] Beals, Brainerd and Smith, 1945, p. 55.

LOOMBLOCKS

Definition. Large sandstone blocks, about 30 to 40 centimeters long, with one or more holes in which the end of a wooden stick could be held. (See fig. 33.) A pair of these wooden sticks, held horizontally, would be used in arranging the warp threads before setting up a vertical loom. Such blocks are characteristically used by the modern Hopi in this manner, as well as incidentally for many other purposes.

Shape. Sides are approximately rectangular, but with many small irregularities, and most blocks are elongated. Corners are rounded and the upper surface is sometimes slightly convex. One block (Awatovi Pueblo IV) has a sloping top with the warp bar hole at the higher end. Two blocks are made of thick slabs previously used as metates (Awatovi Pueblo IV).

Workmanship. Generally good, with emphasis on grinding the surfaces smooth rather than achieving complete symmetry. The marks of pecking still visible on several blocks indicate the manner of preliminary shaping. Ends usually have the greatest irregularity, and corners of several have been broken off subsequent to the original shaping.

Handgrips. These are depressions cut into the ends of some of the blocks, presumably to aid in lifting or carrying. Present in 13, and a single grip in one end of another; absent in 26. In five blocks grips are cut close to the top in each end, so that the portion above has partly broken away. Other grips are approximately centered in the ends. In no case was it hard to decide whether or not a grip was present. It was always carefully cut, either oval or subrectangular, with squared edges and rounded bottom. Holes for handgrips have the following dimensions:

	Mean	Maximum	Minimum
Length	7.9 cm.	9 cm.	7 cm.
Depth	3.8 cm.	5 cm.	1 cm.

Width is almost always just half of length. Most of the Hopi loomblocks described in the 19th century by Stephen and others have handgrips.

Warp Bar Holes. These are the small holes which in modern loomblocks hold the ends of the wooden bars on which is arranged the warp for the vertical loom. This was doubtless their use in the past. The warp bars were held horizontally, hence these holes are in the ends or sides of the blocks, rarely on top. To use holes in the tops, blocks would have to be turned on edge. A bar could be held in two blocks, or one end could be inserted in a small hole in the kiva wall, such as are occasionally found. Most blocks have a single hole in one side, or sometimes in the end when handgrips are absent. The holes are usually just below the upper edge, hence about 10 to 14 centimeters above the floor. Additional holes are probably an indication that the first hole was in an unsatisfactory position, or of too great diameter. Holes are located as follows:

1 hole in side, none elsewhere	13
2 holes in side, none elsewhere	5
3 holes in side, none elsewhere	1
1 hole in side, 1 opposite	5
2 holes in side, 1 opposite	1
1 hole in side, 1 in top	3
1 hole in end	3
1 hole in end, 1 in side	1
position and number unrecorded	8

Size of the warp bar holes varies, but is generally from 1.7 to 3.0 centimeters in diameter.

	Mean	Maximum	Minimum
Diameter	2.2 cm.	4.3 cm.	1.0 cm.
Depth	1.2 cm.	3.2 cm.	0.4 cm.

Use in Pairs. Besides five pairs of loomblocks found on floors of rooms and kivas, there were four pairs in fill at Awatovi and one at Kawaika-a. Such an occurrence in pairs would be expected, since they were probably rarely used singly except for such secondary functions as seats.

Decoration. Figure 33, *e*, is a loomblock with an incised design on the upper surface. It appears to be a conventional "cloud" with a zigzag (lightning ?) beside it. The block is squarer and rougher than most, and has a warp bar hole in each side, but no fingergrips.

Abrading Grooves. Only two loomblocks had grooves such as would result from the grinding of bone tools. One is a block from Kawaika-a which has half a dozen short grooves and two broad concave areas scattered over its six faces. The other, from Awatovi, has 29 holes of varying sizes in its upper face, and a few grooves. The purpose of the extra holes is unknown. One loomblock from Pinedale had been used for abrading small objects,[1] and both Fewkes[2] and Cushing[3] mention that loomblocks are used by the Hopi for shaping small bone or wood artifacts, and grinding pigments.

Size.	Mean	Maximum	Minimum
Length	35.5 cm.	50 cm.	23 cm.
Width	24.1 cm.	32 cm.	17 cm.
Thickness	13.8 cm.	23 cm.	10 cm.

About three-fourths of the blocks are 30 to 45 centimeters long, 20 to 29 centimeters wide and 12 to 16 centimeters thick.

Material. Sandstone, fine- to medium-grained. All but three are of the easily accessible yellow sandstone that outcrops at the mesa rim. Red or gray sandstone was used for the other three.

Provenience.		
Awatovi,	P IV (Y-17)	4
"	P V (17c)	28
"	Unassigned	6
Kawaika-a,	P III-IV	2
Total		40

Details of Provenience. The loomblocks of Pueblo IV date, from Awatovi and Kawaika-a, all came from rubbish fill, except for one used as building stone in the wall between Awatovi Rooms 626 and 627. At Kawaika-a a pair was found in the fill of a kiva (Test 5, Room 2) and an Awatovi kiva, Room 529, had two blocks in its fill.

The Awatovi Unassigned specimens are surface finds, some of which may be the loomblocks Fewkes found in the 17th century kiva he dug in 1892 or 1895.[4]

Of the Pueblo V specimens only nine are from rubbish fill, the others all found *in situ*, mostly on kiva floors.

In Room 788, the kiva directly below the main church of the Mission, there was a fill of clean sand, apparently put in under Spanish instructions to allow the church to be built over its roof. There was hardly any refuse in this fill and the few artifacts in it may represent "offerings"—intentional deposits with some special significance. They included a human femur, a green painted prayerstick, a large chert blade (fig. 27, *a*), and about 50 centimeters below the roof opening a pair of loomblocks.

Test 31, Room 1 (fig. 33, *f*) had two pairs of loomblocks and one single block on its floor. Like nearly all kivas, this one has several rows of floor holes for securing the lower end of the vertical loom after the initial horizontal position on the loomblocks.

Test 22, Room 10 (a kiva) had a pair of blocks stacked on the east bench, and another pair near each other on the bench in the southwest corner. A special feature noted in this kiva and in no others was a series of holes in the vertical front of the benches along the east and west walls, and at the eastern end of the southern bench. These holes, about 1 centimeter deep and 5 or 6 centimeters apart, were in several rows, all about the same distance above the floor as the holes of similar size in the sides of the loomblocks. They may have served to hold the other ends of the warp bars, so that only one pair of blocks would be needed instead of two. In other kivas, where the benches are built up of small stones laid in adobe, or heavily plastered, such rows of small holes may have passed unnoticed, since they would be less conspicuous than those drilled or pecked in the large stones which form the benches of this kiva.

Kiva A contained a single loomblock (fig. 33, *a*) on the floor, near its center. Resting on it was a large stone disk, about 60 centimeters in diameter, perforated with a 15 centimeter hole in its center. Its use is unknown, and the association with the loomblock probably fortuitous.

Test 44, Room 1 is a living room, on the floor of which were the loomblocks in figure 33, *b*, *c*.

Room 454 contained a single loomblock in a rectangular storage bin.

Room 406 was probably a storage room, as it lacked a fireplace but had remnants of three or four bins against the north wall. A single loomblock was on the floor.

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[1] Haury, 1931b, p. 53.

[2] Fewkes, 1898a, p. 626.

[3] Cushing, Fewkes and Parsons, 1922, p. 257.

[4] Fewkes, 1898a, pp. 612, 626.

Room 510 had a loomblock on the floor, and no other artifacts or architectural features.

Figure 33, *e*, was on the floor of Room 601, which had a storage bin and fireplace as its furnishings.

Room 734 was the sacristy of the final church of the Mission, used by the padres during the brief revival of the Mission after the revolt of 1680. Later, probably after 1700, it was used by Hopis lingering in the town. The loomblock was the one already described, with 29 holes of unknown use in its upper surface.

It is interesting to note that of the six living or storage rooms in which loomblocks were found *in situ*, there was only one pair, and even in this room there was no indication that weaving had ever been practiced. Hence it seems probable that the blocks had been removed from kivas to serve as seats elsewhere, and were no longer used for their original purpose.

Occurrence Elsewhere in the Southwest. Loomblocks have not been reported from the greater part of the Southwest, and occur only in Pueblo IV and V sites, so far as is known.

At Showlow a single loomblock was found, in one of the living rooms of the Pueblo.[5] Instead of being squared, it was rounded on the top and three sides, with the base and one side flat. In this flat side, near the top, was a hole less than an inch deep. The block was small, 7 inches wide and 10 inches long.

At Pinedale there were two loomblocks like the one from Showlow, found on the bench at the south end of a kiva.[6] One of the blocks "shows a long groove, evidently where weaving tools were sharpened." This kiva was rectangular, with many of the features of Hopi kivas. Roof beams provided dates indicating that it was in use "soon after 1300."

At Four Mile Ruin, Fewkes found seven loomblocks.[7] There were five on the floor of an excavated room, and the two others were believed to have originally belonged in the room. These were all of the same shape as those at Pinedale and Showlow, rounded with a single flat side in which the hole was cut. Fewkes concluded that they were probably supports for weaving frames, as he had seen loomblocks thus used by the Hopi.

A kiva (R-4) dug in 1928 at Kokopnyama contained two loomblocks like the rectangular ones from Awatovi.[8] They are of sandstone, about 11½ x 8 x 6½ inches and have no handgrips at the ends. A single such block was found on the floor of kiva R-24, which was constructed in 1380, according to dates obtained from its roof beams.[9]

In Colton's synthesis of northern Arizona archæology[10] there is no mention of loomweights among the listed Focus Determinants except in the Tusayan Branch of the Anasazi Root. Here the trait is listed first for the Sikyatki Focus (15th and 16th centuries) and in the San Bernardino Focus (17th century) and Oraibi Focus (19th century). The first two foci are exemplified by Awatovi, and the Oraibi focus is based on the Hopi towns of the last century. The 18th century Hopi are referred to a focus called Payupki, after one of the abandoned villages, and little information is available for a trait list. Loomblocks might be included on the assumption that since the 16th century they have probably been in continuous use by the Hopi.

On the Delgar Ranch, on the Tularosa River (west central New Mexico), Hough found "several subconical blocks like the seats described by Dr. J. Walter Fewkes from Four Mile Ruin."[11] He refers specifically to plate 65 of Fewkes' report, so there is little doubt that his specimens were similar to the Four Mile Ruin loomblocks. This extends the area of distribution outside the Little Colorado drainage, although the Delgar site is only about 60 miles east of the others.

The occurrence of loomblocks at Pueblo IV sites along the Little Colorado drainage just above the Mogollon Rim is significant because there is ceramic evidence indicating a southern movement into the Jeddito district from this region. The Awatovi loomblocks are mostly of 17th century date, and appear to be larger and more rectangular. The rounded form found at Pinedale, Showlow and Four Mile may be a prototype. In the opinion of Deric O'Bryan[12] the Delgar Ranch sites are probably "Middle to Late Pueblo III, belonging to the Reserve and Tularosa Phases," and there are no Pueblo IV sites known in the vicinity. This would suggest an origin for loomblocks just prior to Pueblo IV and would support the hypothesis that the trait originated in the south and spread north to the Hopi later. Their use has not been reported for any of the other modern Pueblos, although the scanty literature on material culture makes this negative evidence inconclusive.

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[5] Haury, 1931b, p. 23.

[6] Haury, 1931b, p. 53.

[7] Fewkes, 1904, p. 159.

[8] Hargrave, 1931, p. 108.

[9] Hargrave, 1931, p. 112.

[10] Colton, 1939.

[11] Hough, 1914, p. 15.

Uses of Loomblocks. For an understanding of the use of loomblocks it is necessary to go to the technical descriptions of Hopi weaving. There are brief discussions by M.-R. F. Colton, Macleish and Stephen[13] which make the process quite clear. In the process of weaving there are two principal steps. First, the warp is arranged by stretching it between two sticks and inserting the proper heddles. Then the warp is placed in the proper position for weaving and the second step, the insertion of the weft, begins. For the first step the warp is *always* held horizontal, and it is here that loomblocks may be used. The actual weaving usually takes place with the warp stretched vertically between a roof beam and special sockets or loops in the floor or a heavy log. According to M.-R. F. Colton, the only weaving done with the loom horizontal is belt weaving, in which one end of the warp is held by a strap around the waist of the seated weaver.

The method of "warping" is described as follows by Macleish, based on observations at Moencopi in 1938. Two cross pieces of wood are held the desired distance apart, parallel to each other, by inserting one end of each stick in a hole in the wall and the other end in a cluster of nails projecting from the side of a long wooden beam. There are several holes in the wall and several clusters of nails, so the warp bars can be adjusted for various sizes of fabric. The warp is wound around these two bars, which are afterwards fastened to the permanent upper and lower beams of the loom. Macleish says that this arrangement for warping "is a modern version of the old loomweight (or set of loomweights)." His Hopi term for the framework is *yawiʔoypi*, almost the same as the term Stephen gives for the loomblock, *yawi'opi*. The process at Awatovi, using loomblocks instead of the wooden beam, must have been very similar. The wall holes are about 8 inches above the floor at Moencopi, similar to the holes at Awatovi in one of the kivas. The greater diameter of the holes at Moencopi (2 inches) might be due to the greater supply of wood there.

Spier gives a description of warping in his discussion of Zuñi weaving.[14] It is quite similar to the technic at Moencopi, using a frame with two wooden side pieces each with a series of holes. This frame is laid horizontally for warping and later the loom is usually set up vertically for weaving, although weaving is sometimes done with the loom horizontal.

The First Mesa Hopi practice in the last century was to use either two loomblocks and the holes in the wall, or to use four loomblocks.[15] Stephen's description of the blocks in use fits the archæological specimens very well: "The *yawi'opi* are four smooth sandstone blocks about 18 x 12 inches and 6 to 8 inches thick, with shallow holes drilled in their sides." The warp bars were 5 to 9 centimeters in diameter, which is a little larger than the holes in 16th or 17th century loomblocks would accommodate.[16]

Stone blocks used as loomblocks are described by Mindeleff for the Hopi (specifically Mishongnovi in 1885) in his study of Pueblo architecture.[17] He gives a clear account of the warping technic, agreeing in detail with that of Stephen, who may have furnished him the information. The holes in the sides of the kiva benches are said to be about an inch in diameter. They also occur in plastered walls and are spaced at intervals, allowing the warp bars to be placed any desired distance apart. Mindeleff suggests that loomblocks are part of the furniture of some houses, as well as common in kivas, but his statement is vague. In his list of features of the kiva, he gives the native name, *yaŭ'wiopi,* defining it as "stones with holes pecked in their ends for holding the loom beam while the warp is being adjusted; also used as seats."

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[12] Personal communication, October 13, 1948.

[13] M.-R. F. Colton, 1938; Macleish, 1940; Parsons, 1936b, pp. 268, 1182, 1185.

[14] Spier, 1924.

[15] Parsons, 1936b, pp. 268, 1182, 1185.

[16] Both methods, with loomblocks and with a wooden beam, are diagrammed in Underhill, 1944, pp. 42, 75.

[17] Mindeleff, 1891, pp. 132, 212, 223.

From the ethnographic data, several secondary uses of loomblocks can be determined. Here, as with many other objects of Pueblo material culture, varied functions often result from the practice of using anything available for any purpose, regardless of what it was made for. The blocks have been called seats by several observers, apparently in ignorance of their original purpose. Cushing referred to them as among the common furnishings in Oraibi homes, "the sitting stone, huge flat blocks . . . carefully fashioned and provided at either end with a horizontal cavity to facilitate handling."[18] And in the kivas, he says, "About the floor are plentifully strewn the huge stone seats before alluded to, sometimes deeply scarred on the bottoms by use for grinding arrowpoints, shell and stone ornaments, and bone implements." They are alluded to as seats in various accounts by Stephen, Mindeleff and Fewkes, also. "In modern Tusayan these seats are commonly made of soft sandstone, and are so few in number that we can hardly regard them as common. They are often used to support the uprights of altars, when they are erected, and I have seen priests grind pigments in the depressions."[19] Stephen, also, observed loomblocks used to hold up the vertical portions of altars, painted boards and tablets. He writes, "Ni'mka laid a loom block (*yawi'opi*) on the floor on each side of the kachina shrine and between them and the ledge set up a stout pole of peach wood. . . ."[20] These blocks apparently play no role in the altar other than a utilitarian one, as they do not appear in the Oraibi versions of the same altars reported on by Stephen. For many altars they are not needed at all, as the paraphernalia can be laid on the floor. Finally, there is a remark by Stephen that several loomblocks piled up on each other were used by girls replastering the kiva roof.[21] Thus, except for arranging the warp for a loom, none of their functions is more than occasional and casual. However, making the blocks large and flat was necessary before they became convenient as seats, stepladders, etc., so the rounded form found along the Mogollon Rim would have had a more limited number of uses.

Summing up the discussion of loomblocks, several conclusions can be reached. First, they were intended for the preliminary step in setting up a loom. Second, they had to be used in pairs, and either one or two pairs were needed for holding the warp bars, depending on whether holes in a wall were available. Third, they served for other uses such as seats, grooved abraders, and altar supports from time to time. Fourth, they were used in the kivas, where weaving was done, and their scarcity at Awatovi outside of kivas, except singly, is evidence that weaving had not yet been moved out of the kivas into private houses where much of it is done today. Fifth, loomblocks occur only in the Hopi towns and in a few sites along the Mogollon Rim to the south, suggesting strongly a connection between these two areas.

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[18] Cushing, Fewkes and Parsons, 1922, p. 257.

[19] Fewkes, 1898a, p. 626.

[20] Parsons, 1936b, p. 838, and a similar description on p. 883.

[21] Parsons, 1936b, pp. 210, 212.

CARVED AND INCISED STONE OBJECTS

CARVED ANIMALS

GENERAL REMARKS

CARVING in the round, although requiring considerable imagination to conceive and carry out, may be quite simple technically. The carving was probably done mainly by an abrading and grinding process similar to that still used by the Hopi in carving wood. By the selection of pebbles or stone fragments of approximately the proper size and proportions there was a minimum of shaping needed. The quadrupeds that were thus carved are plump, with very stubby legs and ears, and with the tail, mouth and eyes indicated in very low relief. The result is surprisingly effective, and would be more so if, as seems probable, paint was used to further distinguish details.

Although there is little stone carving in the Pueblo area, and most of it appears to be relatively late, there is no need to account for it on the grounds of Spanish or Mexican influence. The religious paraphernalia of Catholicism may have influenced the production of Pueblo masks, dance costumes and wooden "kachina" dolls, but the stone carving seems to be an independent tradition.

Whether the much more elaborate carving of the Hohokam area, which was generally in the form of relief decoration on stone utensils, played a part in stimulating Pueblo stone carving is a more difficult matter to decide. Such influence is possible, although there are hardly any specific similarities between the Pueblo and Hohokam stone carving.

QUADRUPEDS

Essential features are indicated with very little work, shaped by grinding and abrading. Legs: either four knobs, or two knobs each divided by shallow groove. Legs only slightly separated from body by constriction of neck, or continuous with body. Mouth: small straight groove. Ears: pair of small knobs, similar to feet. One animal lacks ears. Eyes: shallow holes, absent on one animal but perhaps indicated with painting. Tail: present on four, consisting of small but clearly defined ridge along the back from rump almost to head.

Size. Largest 32 centimeters long, smallest 6.6 centimeters long.

Material.	Fine-grained sandstone	6
	Limestone	3
	Basalt	1
Provenience.	Awatovi P IV (Y-17)	3
	Awatovi P V (17c)	7
	Total	10

Figure 12, *a*, has legs, ears and mouth, with eyes and tail present but poorly defined. Workmanship, excellent. Material, hard vesicular limestone. Length 9.7 centimeters. Provenience: Pueblo V, on left chest of skeleton of Burial 83, in porch of main church.

Figure 12, *b*, has legs, tail, ears and mouth, no eyes. Workmanship excellent, well smoothed all over, broken through neck. Length 32 centimeters. Material, fine-grained light tan sandstone. Provenience: Pueblo IV, in cache under southwest bench of kiva (Test 14, Room 5), with a large number of stone balls and hammerstones. It was found standing near the front of the cache, facing the opening. The other objects were around, under and behind it. The head was broken off, but was with it in the cache. Behind the animal were two large stones of approximately the same size, but of natural shapes. The nearer closely approximates the carved animal in proportions, and would require only painted features to make a creditable animal. The other large stone was a boulder with one surface ground flat.

Figure 12, *c*, has legs, ears, eyes, mouth and tail. Carefully smoothed all over. Fine-grained sandstone. Length 6.6 centimeters. Pueblo V, with Burial 51 in nave of main church.

Figure 12, *d*, consists of head only, with eyes, ears and mouth indicated. Just behind ears is depression 0.8 centimeter deep and 1.0 centimeter in diameter, purpose unknown. Sandstone. Originally would have been about 25 to 30 centimeters long. Pueblo V rubbish fill.

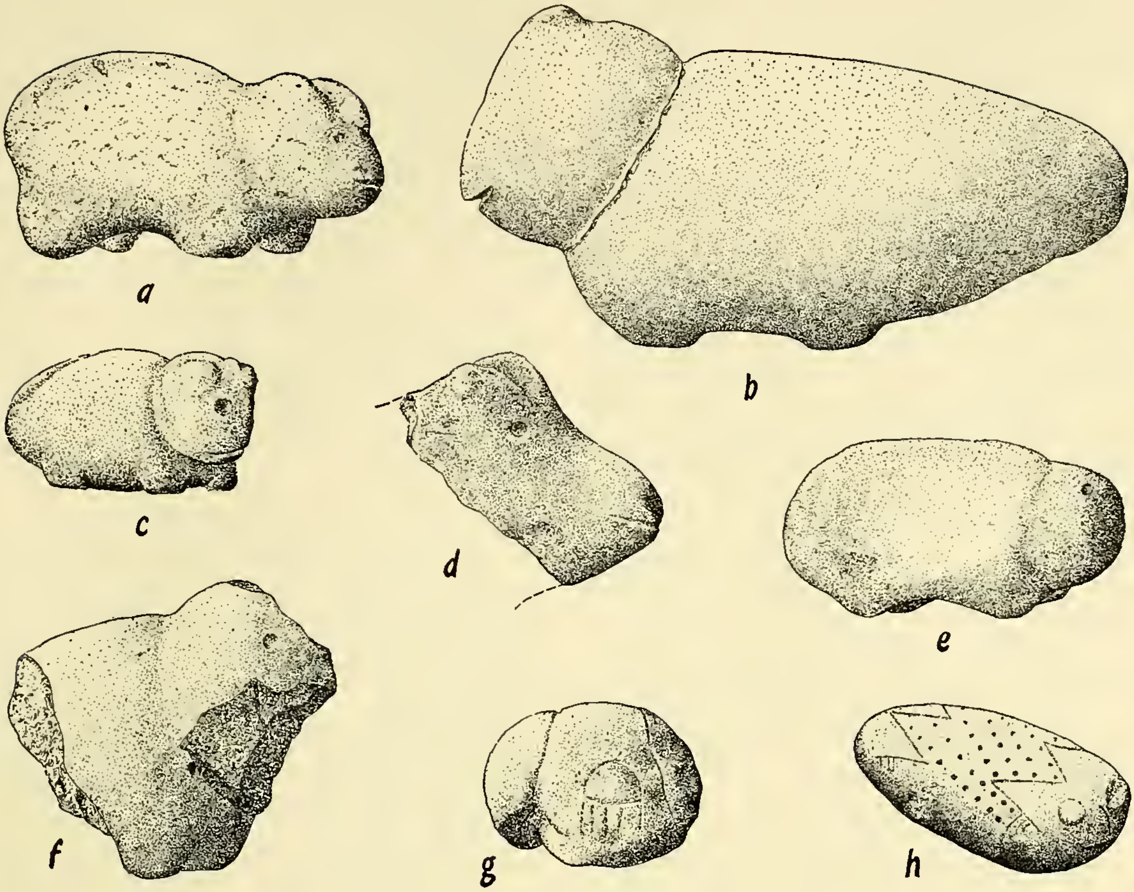

Figure 12

CARVED ANIMALS

a-f, Carved stone animals, probably representing mountain lions. The largest, *b*, is 32 centimeters long.

g, Carved stone bird or insect (?).

h, Carved stone frog.

	Provenience			Catalogue Numbers
a,	Awatovi,	Room 434, Burial 83	Pueblo V	37–111–10/11883
b,	"	Test 14, Room 5, Pit in SW corner of room*	Pueblo IV	39–120–10/17597
c,	"	Room 435, Burial 51, 100–150	Pueblo V	37–111–10/11882
d,	"	Room 430 in pit	Pueblo V	38–120–10/17595
e,	"	Test 40, Room 2, 0–50	Pueblo V	38–120–10/17598
f,	"	Room 786 under 3rd floor	Pueblo V	38–120–10/17596
g,	"	Room 270, 0–100	Pueblo IV	36–131–10/8642
h,	"	Room 529, level unknown	Pueblo IV-V, fill	39–97–10/19896

**b* came from a cache of stone objects which is described in the text.

Figure 12, *e*, is a pebble of natural shape, slightly modified to indicate feet, head and eyes. Sandstone. Length 11 centimeters. Pueblo V rubbish fill.

Figure 12, *f*, is a fragment with forelegs and head, with eyes, mouth and ears (?) indicated. Very smooth as though handled subsequent to grinding and shaping, with breaks partly worn smooth. Fine-grained sandstone. Originally would have been about 15 centimeters long. Pueblo V rubbish fill.

A large cobble, like figure 12, *e*, has feet crudely indicated by means of two grooves, and no other features, although the shape is very much like the carved animals. Both ends are battered from use as a pecking stone. Basalt. Length 19 centimeters. Pueblo V rubbish fill.

Two worn and battered carved animals with heads missing probably resembled figure 12, *a*, when complete. Length 7 centimeters. Both Pueblo IV rubbish fill.

A fragment with hind legs, rump and tail curving up along the back resembles figure 12, *c*. Carefully smoothed surface. Limestone. Originally about 7 centimeters long. Pueblo V rubbish fill.

BIRD OR INSECT (?)

Figure 12, *g*, irregularly spherical with flat under surface. Faint incised lines on opposite sides outline two lobes that may represent wings. Where the head would be is a lightly incised "rain cloud" symbol, consisting of a semicircle with four pendant lines. Surface badly worn. Material, very soft sandstone. Size, 4.7 by 4.7 by 3.4 centimeters. Provenience, Awatovi Pueblo IV (B/Y) rubbish fill.

FROG

Figure 12, *h*. A waterworn pebble has been transformed, with a remarkably small amount of carving, into a delightfully effective figure of a frog. The upper surface has a zigzag of four lines to represent the forelegs, and a similar zigzag to represent the rear legs. Each zigzag terminates in three or four small lines representing toes. Nose and mouth are shown by a horizontal groove with a vertical groove above it. The eyes are the only relief carving. They protrude slightly, as a result of the surrounding surface being ground down. One eye has broken off. Spots on the back are indicated by dots placed in a diagonal pattern. The under side is plain. Undoubtedly the selection of a suitable stone made this figure possible, but the few lines and grooves create their effect through their skillful placement. The material is a light brown quartzite. Size 7.3 by 5.1 by 3.5 centimeters. Provenience, Awatovi Pueblo IV or V (mixed Y-17 and 17c fill of Room 529).

USE AND DISTRIBUTION

All of the quadrupeds were identified by Hopi members of the crew as "tohos," mountain lions. The same term is listed in the vocabulary of Stephen's *Hopi Journal,* and also "tŏhó poko, mountain lion image, fetich (spirit) animal."[1] This identification is also supported by Stephen's sketches of mountain lion images, with the same stubby feet and ears, and the tail curving over the back.[2] Carved mountain lions very much like these were collected at Second Mesa (Mishongnovi) by Mrs. Stevenson in the 1880's and recorded as "To-ho-po-ko."[3] Most of those she acquired were painted with the back yellow, the belly and throat white and a black stripe separating the two colors. Whiskers (?) were indicated by three short horizontal lines on each cheek. Almost identical stone mountain lions were used at Zuñi in the 19th century, and continue to play an important role in religious life.[4] Cushing describes stone mountain lions which were "invariably distinguished by the tail, which is represented very long, and laid lengthwise of the back from the rump nearly or quite to the shoulders, as well as by the ears, which are quite uniformly rounded and not prominent."[5] Other diagnostic criteria, such as erect ears, or extended or drooping tails, serve to distinguish the Zuñi carved animals of other species. At archæological sites the carved quadrupeds rarely conform precisely to these modern standards. But a "mountain lion" was found by Fewkes at Sikyatki, which interestingly contained red pigment in the mouth, and was said by him to be "very similar to one found at Awatovi, and is identical with those made by the Hopi at the present time."[6] I have found no other mention of this Awatovi specimen, and could not find it in the Fewkes collections in the United States National Museum. Presumably it was very like those found by the Peabody Museum Awatovi Expedition. At Betatakin, Judd found a small carved animal with the same stubby feet and ears and an extended tail.[7] Fewkes reports the finding in the Mesa Verde district of "the torso of a mountain lion" near Pipe Shrine House and the head of a "mountain sheep" at the same site.[8] A carved "bear" (head and forelegs only) was found in the kiva ventilator of Far View House.[9] Carved animals have been found at other sites in the Southwest (in the Mesa Verde area, at Whitemound Village, Elden Pueblo, Pecos, Puyé, Kintiel and the Village of the Great Kivas) but they resemble the Awatovi specimens less than do those from Betatakin and Mesa Verde. They serve to indicate, nevertheless, that a knowledge and skilled practice of stone carving was not wholly restricted to the Hohokam culture. Hohokam carving attained a higher degree of skill, but is mostly restricted to relief designs on palettes, mortars and bowls, and to small objects such as shell ornaments, and thus seems to be mainly decorative rather than symbolic.

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[1] Parsons, 1936b, p. 1306.

[2] Parsons, 1936b, figs. 22, 375.

[3] U. S. National Museum collections.

[4] Kirk, 1943. This recent study corroborates Cushing at most points.

[5] Cushing, 1883, p. 25.

Since the Awatovi carved mountain lions are a characteristic item of Hopi ritual equipment, the rather extensive information on their modern use serves to suggest the role they probably played in the past. In describing an Antelope altar which had seven mountain lion effigies along the edge of a sandpainting, Stephen states that they "are the watchers."[10] Similarly, of the picture of a mountain lion which forms the central figure of another Antelope kiva sandpainting, he says, "Lion is watcher chief."[11] Fewkes lists the Momtcita and Snake altars as the only ones on which carved animals are used,[12] and observes that "among the Tusayan Indians [Hopi] the mountain lion is looked on as a guardian of cultivated fields, which he is said to protect."[13]Titiev found that "these animals and their directional order were invariably listed in the same sequence by my informant and seem to have been rigidly fixed in the ritual."[14] His list consists of north, Mountain Lion; west, Bear; south, Wildcat; east, Wolf; above, Vulture;[15] below, Snake. These directional creatures are probably associated with the idea of protection, as Fewkes indicated, and perhaps also of hunting.

At Zuñi the mountain lion images are very nearly identical with those of the Hopi. Besides the association of animals and directions, which is almost identical with Titiev's Oraibi list given in the previous paragraph, there is also an association of colors and directions which, according to Cushing, determined the colors used in decorating the animals. There is no indication that the Hopi used a "directional" color on their mountain lions, as the painting on the carvings purchased by Mrs. Stevenson appears to be an aid to realism. The Zuñi figures, in addition, usually had chipped stone points fastened to them.[16] None at Awatovi had stone points with them.

There are carved mountain lions at Sia Pueblo very much like the Hopi ones, and similarly used on certain altars, to represent "the cougar of the North."[17] The same recurved tail along the back characterizes the stone mountain lions at Laguna, about which little has been learned.[18] Similar small carved figures have been reported from Isleta, too,[19] but from no other eastern pueblos. Negative evidence on this point means little, however, because secrecy has made it difficult for field workers to obtain complete accounts of ritual affairs. It is interesting that these stone figures occur at Sia and Laguna, both Keresan speaking towns, because this furnishes one more item in the elusive series of Hopi-Keresan connections.[20] When data from prehistoric Keresan towns are published there should be further clarification of these connections.

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[6] Fewkes, 1898a, p. 730, pl. CLXXII, *b*, *c*.

[7] Judd, 1930, p. 55, fig. 6.

[8] Fewkes, 1924, p. 384, pl. 4, fig. 4.

[9] Fewkes, 1917, p. 480.

[10] Parsons, 1936b, p. 673.

[11] Parsons, 1936b, p. 640.

[12] Fewkes, 1924, p. 385.

[13] Fewkes, 1898a, p. 545.

[14] Titiev, 1944, p. 157, n. 17.

[15] Titiev gives "Vulture ?" as the translation of *Kwatoko*, but in Stephen's glossary *kawa'a* or *kwa'hü* is translated as eagle, and *Kwatoko* as Beyond-the-sky-eagle (Parsons, 1936b, pp. 1238–1240), so Eagle would probably be correct.

[16] Cushing, 1883.

[17] M. Stevenson, 1894, p. 77, pl. XV, XIX.

[18] Parsons, 1920b, pp. 118, 127, fig. 20.

The frog is generally regarded by the modern Hopi as suggestive of water. "Frogs constantly pray for rain and hence are held as sacred."[21] Stone effigies of frogs, however, are not common and the only similar carvings of frogs have been found at Chaco Canyon sites. At Pueblo Bonito there was a very handsome carved frog of jet, 8.2 centimeters long, with turquoise inlay.[22] A large number of small jet and turquoise frog pendants were found at Aztec Ruin. They are only about 1.0 to 1.5 centimeters long but have the same protruding eyes that appear on the Pueblo Bonito and Awatovi frogs.[23] South of the Pueblo region the frog probably had an approximately similar role, as a symbol of water. It occurs frequently in shell and mosaic work in the Hohokam region.[24]

INCISED DECORATION

General Remarks. In the Jeddito district very little use was made of the potentialities of incised decoration in stone, and no bowls or mortars with carving in relief occur. Along the mesa rim below the sites and near trails and springs throughout the district there are numerous pecked and/or incised designs on outcrops of sandstone. The subject of such petroglyphs, however, is beyond the scope of this report. It has been suggested that such petroglyphs were not meant to be decorative, but to record a visit to a spot of importance.[25] The lack of incised designs or symbols on building stone in the pueblos bears this out, since it would have been extremely easy to produce elaborate incised decorations on the stone walls and floors, if decoration had been desired. When wall decoration was wanted, however, it was generally painted on plaster, and the technic of incising designs on stone was reserved for the "visiting cards" left along trails.

Only a few exceptions occurred to this general absence of incised decoration on stone, and they will be described in detail. No carved slabs were found resembling those at Oraibi used in scoring a dice game,[26] or the Oraibi slab with six human figures which symbolizes the traditional authority of the clans over the village lands.[27]

Description and Discussion. At Site 4 there were four building stones on the outer face of the south wall of the Late Pueblo III unit which bore carefully incised geometric designs (fig. 34, *b–f*). The designs do not continue from one stone to the next and only two of the decorated blocks adjoin each other. They are all in the lower three courses of masonry. The designs consist of triangles, step figures and concentric rectangles. There is no indication that the stones were incised while in place, and the lack of continuity in design makes it probable that they were "robbed" from a previous building. Site 4 and the adjoining Site 4A represent a fairly continuous occupation from Basket Maker III through Pueblo III. Similarly incised building stones have been reported from several Mesa Verde ruins (Sun Temple, Far View House, Cliff Palace, Spruce Tree House).[28] In all of these ruins the designs are on scattered and unrelated stones. "From the arrangements of the incised rocks in the walls, some high, some low, it appears that the decoration was placed upon the building stone before it was set in the wall."[29] In the La Plata district there are two examples of this wall treatment, of early Pueblo III date (Site 39, Bldg. 1-R23).[30] At Kokopnyama "incised stones . . . detached from the walls" have been reported.[31] Possibly the same decorative treatment was practiced in the Tularosa River district, as Hough states, "Some rooms are laid up with thin slabs of white stone . . . . In one instance on the Tularosa the edges of many of the slabs were decorated with grooves and incised lines forming ornamental patterns."[32] In Marsh Pass Ruins 8 and A there are incised designs on building stones, generally geometric and similar to pottery decoration.[33] At Awatovi the efflorescence of painted mural decoration may have stifled any tendencies toward further development of incised decoration on masonry. But nowhere in the Southwest does the technic seem to have become more than an occasional and somewhat random matter.

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[19] Parsons, 1920a, p. 60.

[20] See Parsons, 1936a, for a discussion of other aspects of this problem.

[21] Parsons, 1936b, p. 707.

[22] Pepper, 1905, pp. 190–92, pl. XVII.

[23] Morris, 1919, pp. 96–97, fig. 70.

[24] Haury, 1937a, pl. CXIX. Haury, 1945a, p. 154, fig. 93.

[25] M.-R. F. and H. S. Colton, 1931.

[26] Culin, 1907, p. 161, figs. 194–96.

[27] Titiev, 1944, p. 60, fig. 4.

[28] Fewkes, 1916, p. 12, fig. 4. Fewkes, 1917, p. 472. Fewkes, 1911a, pl. 23, 67. Franke, 1932, p. 29, fig. 5.

In the Mission at Awatovi a masonry door plug included one slab (fig. 20, *b*) on which there were several incised patterns. The door from which it came had led from a public passageway into what is believed to have been a private "Friars' Chapel." It was plugged some time after the abandonment of the main church for religious activities in 1680. The father of one of the Hopi workmen employed at Awatovi said that he could make out, among the dozen small incised designs on the slab, "the signs of the Bow, Sun and Snake Clans," and also a sign signifying peace, the handclasp sign. This symbol, consisting of two short interlocked curved lines, is pictured by Stephen, who says it means "with our friends," that is, military allies. In the glossary it is "friendship mark," *nakwachveta*.[34] The Bow symbol, resembling a slender letter B, appears twice. It is the same Bow symbol reported by Colton, on the basis of Hopi informants,[35] except that one of the bows has an arrow across it. The Snake symbol is presumably a zigzag, similar to the one illustrated by Colton. The Sun symbol may be the circle with four pairs of short radiating lines, like the New Mexico State emblem used on automobile license plates. None of the other incised symbols on the slab have been identified.

Figure 34, *a*, is a pair of slabs in the stone pavement of the southern bench of an Awatovi kiva (Room 529, Pueblo IV, Y-17). A similar pair of decorated slabs was at the other end of the bench. The radially placed figures may represent tadpoles. They are from 8 to 18 centimeters long. It may be a coincidence that the carved frog previously described was found in the fill of this kiva.

A slab from one of the 17th century Awatovi houses (Room 616) has a pattern of faintly incised or scratched lines on it. There are several long straight parallel lines, with short sloping lines between them, and a small area of perpendicular cross-hatching. The work is careless and might be the result of a few idle moments and a sharp stone.

There were two small tabular pieces of stone from Pueblo IV (B/Y) fill at Awatovi that bear what seem to be incised designs. Figure 39, *m*, is a coarse sandstone fragment 7 centimeters across, ground smooth on both faces. One face has a pattern of squares 1.2 centimeters across, with the incisions filled with orange paint. This pattern is similar to the representations of corn in some of the Awatovi kiva murals, except that they usually have a dot in the center of each square.[36] Figure 32, *a*, is a small rectangular tablet of extremely fine-grained white material resembling volcanic ash. It is 3.7 centimeters wide, carefully smoothed all over, and is decorated with two shallow pits near one edge and a double line with ticking near the other edge. Its significance is unknown.

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[29] Franke, 1932, p. 31.

[30] Morris, 1939, pl. 5.

[31] Hargrave, 1931, p. 99.

[32] Hough, 1907, p. 15.

[33] Kidder and Guernsey, 1919, p. 196, fig. 97.

[34] Parsons, 1936b, p. 1258, fig. 83.

[35] Colton, 1946a.

[36] Similar representations of corn by the Hopi are shown in Parsons, 1936b, figs. 21, 55, 434.

The loomblock with incised decoration has already been described, figure 33, *e* and p. 153.

Provenience and Summary.

Site 4,	P III: building stone	4
Awatovi,	P IV (B/Y): small tabular objects	2
"	P IV (Y-17): slabs in kiva floor	4
"	P V (17c): building stone	2
	Total	12

MEXICAN JADE HEAD

A fragment of jade with a carved human face was found in the refuse of the main church at Awatovi.[37] Presumably it was imported during the Spanish occupation, by one of the supply caravans from Mexico. The head is carved in what is known as the Oaxaca style, but its exact origin cannot be determined owing to the widespread use of this style of carving.

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[37] Brew, 1940, pp. 346–48, has described this jade and its implications. The illustration there is *twice* actual size, although erroneously stated to be actual size.

TCAMAHIAS AND HOES

GENERAL REMARKS

HOEING and digging were undoubtedly important activities of the prehistoric Jeddito Indians, since their subsistence was to a large degree based on agriculture. The scarcity in our excavations of stone implements suitable for these purposes probably means that wooden digging sticks, similar to those in use until recently, were the chief agricultural implement.

A few hoes with broad flat blades and narrow handles come from Awatovi, and a single triangular hoe notched for hafting.

It is likely that some of the implements called "tcamahias" were hoes, or were made in imitation of hoes. The Hopis apply the name to hoe-like objects now used on their altars in certain ceremonies. Morris has demonstrated that in the La Plata district objects of this sort were undoubtedly agricultural tools, being sufficiently plentiful for everyday use and often extremely worn down on the broad end. Some of the Awatovi tcamahias are so finely polished, with no traces of wear, that a "ceremonial" use is probable, rather than an agricultural.

TCAMAHIAS

FIGURE 35, *a–j, l, m.*

Definition. Ground or polished blades of hard, fine-grained stone, tapering from a narrow butt to a broad, thin cutting edge. Called "skinning knives" in the San Juan region.

Shape. Six are unshouldered, slender triangles, with the small end rounded and the broad end thinned, either rounded or straight (fig. 35, *b, c, d, j*). Four are shouldered, triangular (fig. 35, *a, h, i*). Six are shouldered, oval (fig. 35, *e, f, m*). Eight are fragments (fig. 35, *g*) of which at least three were shouldered and one had four small notches ground in the edge of the blade. Figure 35, *l*, is a fragment of a butt end with two notches in each edge.

Finish. Degree of finish varies from a high polish on those of hornstone, to flaking and partial grinding on some of those of igneous rock. Slate specimens are intermediate in excellence of finish. Even the most carefully finished hornstone blades have one or two flake scars that are not entirely obliterated by grinding, but are smoothed as though by long continued handling.

Wear. No signs of wear on the edges can be discerned, although the sloping end, as in figure 35, *b*, is just the shape that would result from long use. The faces and long edges of the tcamahias, and even the butts, have just about as much smoothing and polishing as the blade ends.

Pigment. A fragmentary blade of slate and a shouldered triangular fragment of limestone have stains of red pigment on one flat surface. This may be from the use of these fragments as small paint grinding slabs.

Size.	Mean	Maximum	Minimum
Length	17.7 cm.	24 cm.	14 cm.
Width	7.0 cm.	9 cm.	5 cm.
Thickness	1.5 cm.	1.9 cm.	1.0 cm.

The shouldered tcamahias average 1.5 centimeters wider than the unshouldered, and are slightly shorter and thicker.

Material.

	Hornstone	Limestone	Spotted Slate	Plain Slate	Igneous Rock	Total
Unshouldered:						
Triangular	4	—	—	1	—	5
Ellipsoid	—	—	—	1	—	1
Shouldered:						
Triangular	2	1	1	—	—	4
Oval	—	—	1	1	4	6
Fragments	2	—	1	2	3	8
Notched	—	—	1	—	—	1
Total	8	1	4	5	7	25

The hornstone is a very fine-grained, hard, laminated siliceous material, ranging in color from cream to various shades of brown. The only source in the Southwest is probably the one reported close to the Four Corners, just south of the San Juan River.[1] The limestone may be a local material, from the Tertiary formations which overlie parts of Black Mesa. The spotted slate is similar to that described by Morris as coming from Mitten Rock, near Shiprock, in the northwest corner of New Mexico.[2] It appears to have numerous tiny very black inclusions of some harder material. The plain slate and the igneous rocks probably come from near the Jeddito district, although their sources are not known.

Provenience.	Pink Arrow,	P III-IV	1
	Awatovi,	P III (W-O)	2
	"	P III (B/O)	2
	"	P IV (B/Y)	4
	"	P IV (Y-17)	2
	"	P V (17c)	12
	"	Unassigned	2
	Total		25

The 11 finest tcamahias, for which a ritual use seems almost certain, are all from Awatovi, two from Pueblo III (W-O and B/O), one from Pueblo IV (B/Y) and eight from Pueblo V (17c).

HOES (?)

Definition. Tools shaped partly or wholly by grinding, with a broad blade, relatively thin and sharp edged. Thicker blades, entirely or mostly chipped, might have served as hoes as well as axes, but do not appear to have been made specifically for agricultural use.

Description. Figure 35, *k*, unique, a thin slab of laminated sandstone, triangular, with two deep notches as though for hafting. No indications of wear on pointed end. Awatovi Pueblo IV (O-Y).

Figure 35, *r*, rounded with crude handle, faces ground partly smooth, edge sharp with small fractures as though from use in gravelly soil. Felsite porphyry. Awatovi, surface find.

Figure 35, *s*, crude with one ground face that suggests it is made from mano fragment. Edges roughly chipped. Hard fine-grained sandstone. Awatovi Pueblo IV (B/Y).

Figure 35, *t*, subrectangular, handled, shaped by chipping and grinding, sharp edge. Felsite porphyry. Awatovi Pueblo IV (Y-17).

Figure 35, *u*, roughly flaked and ground blade, one shoulder broken off. Fine-grained quartzite. Awatovi Pueblo IV (B/Y).

Provenience.	Awatovi,	P IV (O-Y)	1
	"	P IV (B/Y)	2
	"	P IV (Y-17)	1
	"	Unassigned	1
	Total		5

DISTRIBUTION AND USE OF TCAMAHIAS AND HOES IN THE PUEBLO AREA

While stone hoes with broad blades and narrow handles have continued in use until recent times in the Pueblo area, as agricultural implements, the slender blades called tcamahias seem to have become symbols and ceased to be used as actual tools. There is little doubt that they were formerly made as tools and used in agriculture.

In the San Juan area, where tcamahias have been found most plentifully, the blades are worn, scratched, chipped and occasionally broken and rehafted. Morris states "that it seems probable that the tools were used more for planting, cultivating, and weed cutting than for actual excavation, that is, where a light thrust rather than a heavy blow would suffice."[3] For such use a handle would be necessary, and stains of decayed wood indicate, according to Morris, that they were fastened on the end of a stick parallel to its long axis. The term "skinning knife" which has unfortunately become attached to these tools seems to have arisen from the impression that the better polished and more fragile tcamahias are unsuitable for digging or hoeing. There seems to be no good indication that they served for skinning, although, of course, it cannot be proved that they did not.

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[1] Morris, 1939, p. 139.

[2] Morris, 1939, p. 139.

[3] Morris, 1939, p. 139.

The former agricultural use of tcamahias is rendered even more probable by the survival of the shape for Hopi hoes of other materials. Hoes of this general form, made all of wood or of wood with iron blade, are still used by the Hopi. They might better be called cultivators, since they are used in the manner which Morris suggested for tcamahias. "The hoe of aboriginal pusher type (wíkya) . . . shaped something like a canoe paddle cut down the median line . . . the curved edge bevelled and sharpened . . ." is reported from Second Mesa. "It was used with a pushing away motion. . . ."[4] A hoe of almost the same shape is mentioned by Voth, from Oraibi (Third Mesa). It is "a small triangular, spade-like iron implement, said to have been made by the Spaniards when they were still in the country, but now used by the Snake priests only for digging up snakes on the snake hunts. In various ceremonies a *wona a' wika* (board or plank wíka) is used, which, tradition says, was also used as a weeding implement, and which was superceded by the better *ship* (iron) *wíka*, made by the Spaniards."[5] This may be a survival of the type of stone hoe represented by the tcamahia.

Turning to the archæological occurrence of tcamahias, it is worthwhile to list the known specimens, as they come from a relatively limited area and time.

Alkali Ridge, Pueblo II, the earliest tcamahia yet reported (Brew, 1946, p. 241, fig. 175, *k*)
Cannonball Ruin, Colorado, Pueblo III (Morley, 1908)
Mesa Verde sites (Nordenskiold, 1893, p. 97, pl. 36–37)
Cliff Palace, Mesa Verde, Pueblo III (Fewkes, 1911a, p. 65)
Spruce Tree House, Mesa Verde, Pueblo III (Fewkes, 1909, p. 39, pl. 21, *b*)
Grand Gulch, Utah, date uncertain (Kidder and Guernsey, 1919, pl. 52, *m*. Rinaldo, 1941a, pp. 53–54, 209)
La Plata Sites 36 and 41, Pueblo III (Morris, 1939, pp. 49, 87, 98, 100, 101, 105, 138–140, pls. 165–71. Tcamahias appear "at or shortly before Pueblo III.")
Tseh So, Pueblo II-III, an atypical specimen (Hibben, 1937, p. 95, pl. 20, *b*)
Leyit Kin, Pueblo III (Dutton, 1938, p. 69, pl. 6E)
Aztec Ruin, Pueblo III (Morris, 1919, p. 24, fig. 12, *a*, *b*)
Kayenta Site RB 568, Pueblo III (Beals, Brainerd and Smith, 1945, p. 79, fig. 16, K, L)
Betatakin, late Pueblo III (Judd, 1930, p. 55)
Marsh Pass Ruin A, early Pueblo III (Kidder and Guernsey, 1919, pp. 125–26, pl. 52, *l*)

No tcamahias have come from the prehistoric Rio Grande pueblo sites, and there is only one occurrence previous to Pueblo III (at Alkali Ridge, Utah). They appear to be chiefly a San Juan-Mesa Verde trait, which spread south into Chaco Canyon and via the Kayenta region into the Hopi country. This spread may have occurred at the time of the desertion of the San Juan, or northern, Pueblo area, probably during the 14th century. Slender blades of the same general shape, incidentally, have been found at the Mattocks Ruin, a Three Circle and Mimbres Phase site far to the south,[6] but lacking any other indication of San Juan contacts for this site, the similarity must be considered a coincidence.

The material of which many tcamahias are made lends support to the idea of the San Juan as the center of their origin. As previously pointed out, no source is known for this distinctive laminated hornstone except the spot suggested by Morris, about 10 miles from the Four Corners. It would be possible for the material to have been quarried on special trips by the Indians of Chaco Canyon and the Hopi. Another possibility is that all the tcamahias found at more distant sites are heirlooms, brought from former settlements and cherished through the centuries because of their importance in ritual and ceremony. This would imply that the special significance attached to them at present also existed in the past, something for which we have no direct evidence.

It may be important that their Hopi name, tcamahia, is a Keresan word.[7] On the basis of this word, and several other similarities between Hopi and Keres ceremonies, Parsons[8] identifies as of Keresan origin the Hopi Snake-Antelope Societies, and perhaps elements of other societies, in which tcamahias are used ritually. The contact and transfer is suggested as "a long period before the Spanish invasion." Since tcamahias are not known archæologically from the Rio Grande, and are known in both the San Juan (early Pueblo III) and the Jeddito district (late Pueblo III and Pueblo IV-V) it is possible that the Keresan pueblos received the trait from the Hopi or from mutual predecessors in the north.

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[4] P. Beaglehole, 1937, p. 37. This implement is illustrated by Underhill, 1946, p. 34.

[5] Voth, 1903b, p. 286, pl. 178. See also Voth, 1901, p. 98, pl. 57.

[6] Nesbitt, 1931, p. 80, pl. 35.

[7] Fewkes, 1897c, pp. 293, 306. Parsons, 1936a, p. 555.

Tcamahias are used on altars in several Keresan pueblos, and also at Zuñi.[9] At Laguna the term applies to conical stones of natural (?) origin, rather than to hornstone blades.[10] At Ácoma, Sia and Santo Domingo the term refers to the War Gods, but at least at Ácoma there are actual tcamahias on the altars.[11] The knives used on the Snake Society altar at Sia are equated by Fewkes with Hopi tcamahias.[12] Consequently, even though the concept and the artifact have both probably acquired local distinctions of meaning in each town, they may reflect a common origin of the rituals and beliefs with which they are associated.

To summarize, before discussing the modern Hopi use of tcamahias: a stone hoe or cultivator of special form was used in the San Juan region quite commonly in Pueblo III times and recently the Hopi used a similar tool or a modification of it in wood or iron. The finest of these stone hoes are used by the Hopi in ceremonies that may have a Keresan origin, beginning possibly as early as the 13th or 14th centuries. Since the material may all come from a single source near the Four Corners, modern tcamahias may all be heirlooms dating back to the exodus of pueblo peoples from that area.

There is abundant information on the function of tcamahias in certain Hopi ceremonies, chiefly in the detailed records made by Voth and Stephen, and also in less complete notes by other observers. During the Snake Ceremony at Walpi there are tcamahias laid along three or four sides of the "altar" or sand painting in the Antelope Kiva.[13] In the same ceremony at Mishongnovi two tcamahias are contained in the "tiponis" (corn and feather fetish bundles) which stand beside the sand painting.[14] Stephen reported that at each of the Second Mesa towns a single tcamahia was used in this ceremony, in contrast to the 9 and 17 specimens he saw at Walpi (First Mesa) in 1891 and 1893. The only other occasion on which tcamahias form part of the ritual equipment is the initiation of children into the "Katcina Cult" during the Powamu Ceremony.[15] Since this ceremony has never been witnessed completely on First and Second Mesas, it is not known if they use altars for this ceremony similar to the one at Oraibi, which has a tcamahia and an ear of corn oriented with each of the four directions. In addition to the placing of actual tcamahias on altars, the word is used in ritual songs or chants of the Snake Ceremony.[16]

The significance of all this is expressed by the Hopi attitude toward the tcamahia: "Chamahia are fetish stones, in Pueblo opinion representing warrior spirits, anthropomorphic beings of an earlier age, turned to stone."[17] "The *chamáhiya shinyümü* are originally the Stone People . . . and these people were spread to the 4 corners of the earth. . . . We pray for them to come from the 4 quarters."[18] The traditional identification of the Ácoma and Laguna people with "the Chamáhia" and with the northwest is reflected, perhaps, in the Hopi belief in the Ácoma and Laguna origin of the Snake Clan.[19] Further knitting together this network of associated symbols and traditional history is the relation of the Snake Clan to warfare,[20] and the consequent identification of the tcamahia as "implement (hoe) and weapon (axe) combined, the war gods' weapon."[21]

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[8] Parsons, 1936a, p. 557.

[9] Parsons, 1939, p. 333. J. Stevenson, 1883a, p. 342, fig. 355.

[10] Parsons, 1920b, p. 118, fig. 19. Parsons, 1939, p. 194.

[11] Parsons, 1939, p. 194.

[12] Fewkes, 1895, M. Stevenson, 1894, p. 77.

[13] Parsons, 1936b, pp. 596, 673, pl. 17, fig. 365. Bourke, 1884, pp. 25–26, pl. 20.

[14] Dorsey and Voth, 1902, p. 210.

[15] Voth, 1901, p. 53, pl. 95. Titiev, 1944, p. 116.

[16] Fewkes, 1897b, p. 293. Parsons, 1936b, p. 708.

[17] Parsons, 1936b, p. 555.

[18] Parsons, 1936b.

[19] Parsons, 1936b, p. 714.

[20] Parsons, 1936b, p. 577. Titiev, 1944, p. 152.

It is certainly hopeless to seek logic in these varied functions and meanings, if the logic is to be that of our own culture. But to the Hopi there is probably nothing inconsistent in the complex role of these stone artifacts, first, as cultivating tools of an ancient type now supplanted by other forms of tools, except for their special use by snake hunters before the Snake Ceremony; second, objects of traditional sacred significance included in the assemblages of ritual paraphernalia for ceremonies of the Snake Society; third, symbols of a mythological people linked with the legendary history of the Snake Clan and of the Keresan Pueblos; and fourth, appropriate weapons for the ancestral Snake Clan warriors. It is not surprising that archæological evidence is lacking for the Hopi belief that these objects are weapons. This function has been attributed, no doubt, because of their association with and use by the Snake Clan, who are associated with warfare. The believed connection of tcamahias with the Keres may eventually be shown to be correct, but archæological evidence is lacking at present. The most significant fact about the tcamahia is its limited prehistoric distribution, and its definite association with two linguistic groups of the modern Pueblos, the Hopi and Keres.

Hoes, as distinct from tcamahias, can be discussed briefly. Those found at Awatovi, with a broad blade and narrow handle, are of a form little used in the Southwest. Similar hoes are reported from Pueblo Bonito,[22] and near Sayodneechee Ruin 2, in the Monument Valley area.[23] Elsewhere hoes are less specialized. Notched, oval, or triangular hoes are frequently produced by flaking and chipping and are scarcely distinguishable from notched crude axes, for example, at Pecos,[24] and the Piedra sites.[25] In the San Francisco Mountain area a triangular notched hoe is typical, although they are not particularly numerous.[26]

Cultivation in the Southwest probably depended mainly on the digging stick, whose primary purpose was loosening the soil for the planting of seeds. Except when provided with a projecting footrest, it was used from a kneeling posture, jabbed downward and pulled towards the user.[27] For subsequent work on the field, mainly weeding and irrigating, none of the various types of hoes can have been very satisfactory. The notched hoes, both oval and triangular, could have been hafted in a forked stick perpendicular to the handle, like modern steel hoes, or parallel to the handle like an axe.[28] In either case they could not have been strong enough to be used vigorously in hard clayey soils. In sandy soil they would have been more adequate. A stick with a paddle shaped end, or a hafted tcamahia, would, of course, have been used with a slashing and chopping motion. The lack of a completely effective wooden or stone hoe and the importance of agriculture made iron hoes one of the most valued introductions of the Spanish. Garces reported that in the late 18th century the Hopi were the principle middle men through whom the Havasupai and other tribes obtained Spanish cloth, cows, horses and iron hoes from the Rio Grande.[29] Nearly a century later, in 1865, the Pueblo Indian Agent reported, "The corn and implements turned over by you for distribution have all been issued, and I can assure you that it was a great blessing to them. . . . I found them very poor and badly in need of assistance; they had scarcely any implements worthy of the name. They had no hoes, no spades that I could see; the corn, which is usually their main crop, they planted by the aid of sticks, by digging holes in the ground, into which they dropped the seed."[30] Bourke spoke in 1884 of stone tools as being "still plentiful in all the towns, more particularly those farthest to the west, but their use is rapidly fading away before the introduction of American steel and iron ware."[31] He says of Mishongnovi, "An assortment of agricultural implements, hoes, spade and shovels, of American manufacture, was to be seen in every dwelling."[32] At Shungopovi, "In an inner room of the house of the Governor were piles of American hoes, axes and spades."[33] However, as late as 1890 and 1891 Julian Scott reported that "A few of the Moquis use modern hoes, beyond which they possess no implements for farming."[34] Hough stated in 1918 that "The introduction of iron has been slow . . . the Hopi probably received their first iron from the Rio Grande Pueblos in the form of crude, heavy hoes."[35]

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[21] Parsons, 1936b, p. 625.

[22] Pepper, 1920, p. 188, fig. 22, *b*.

[23] Kidder and Guernsey, 1919, p. 126, pl. 52, *n*.

[24] Kidder, 1932, p. 58, fig. 35, *a*.

[25] Roberts, 1930, p. 149, pl. 46.

[26] Colton, 1946b, 286–87.

[27] See Thompson and Joseph, 1944, p. 21, for a good illustration of this technic. The only published illustration I know of the footrest type of digging stick in use is in Donaldson, 1893, the 3rd plate after p. 121, upper right corner.

[28] Bartlett, 1934, p. 24.

[29] Coues, 1900, p. 345.

[30] Quoted in Donaldson, 1893, p. 34.

[31] Bourke, 1884, p. 251.

If these accounts suggest a slowness to adopt a tool so valuable for farmers, it may be partly accounted for in two ways. First, hoes had been relatively little used in prehistoric times, as the tcamahia type of hoe was really a stone-tipped digging stick and was used with a motion quite different from that required for a modern iron hoe. A complete reversal of habitual motions had to be learned. Secondly, iron may have been regarded as inappropriate or even definitely harmful when used in fields. Beaglehole says that iron instead of wood is sometimes used for digging sticks, "but the more conservative deplore this departure on the theory that the iron becomes hot in the sun and tends to scorch the seeds when they are placed in the planting holes."[36] Such conservatism, which is characteristic of many aspects of Pueblo life, would have tended to keep in use the less adequate stone hoes and the digging sticks, even though iron hoes gradually became available.

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[32] Bourke, 1884, p. 289.

[33] Bourke, 1884, p. 324.

[34] Quoted in Donaldson, 1893, p. 64.

[35] Hough, 1918, p. 270.

[36] E. Beaglehole, 1937, p. 39.

STONE BALLS

Description. Shaped by grinding, to a more or less spherical shape, usually somewhat flattened (oblate spheroid) or occasionally multifaceted as a result of the grinding process. These balls are not of natural origin (in contrast to spherical concretions) and they are not pecking stones, since they lack the type of battered surface that results from such use. All have been intentionally ground to their present shape.

Size. Mean diameter 5.5 centimeters, maximum 10 centimeters, minimum 2 centimeters. More than three-fourths are from 4 to 6 centimeters inclusive.

Material.

Yellow sandstone, fine- to medium-grained	53
Quartzite	8
Basalt	1
Pumice	5
Light gray tuff	1
Concretions	3
Unrecorded	8

The surface of the concretions has been ground and smoothed, although they were probably nearly spherical to begin with. All five of the pumice balls are from Site 264; the material is black, extremely vesicular and light weight. The sandstone, of which all the largest balls are made, is poorly compacted and very easily worked. The quartzite and basalt balls are about the size of pecking stones, but have been smoothed by grinding, although it is possible that they were reduced to their present shape by use for pecking and pounding.

Provenience.	
Site 264, BM III-early P I	7
Pink Arrow, P III-IV	2
Awatovi, P IV (B/Y)	4
" P IV (Y-17)	26
" P V (17c)	38
Kawaika-a, P III-IV	2
Total	79

The cache under the southern bench of a Pueblo IV Awatovi kiva, Test 14, Room 5, contained 17 of these balls, along with about 30 other stone implements and a large carved stone mountain lion.

Another Awatovi kiva, Test 31, Room 1 (Pueblo V) had two stone balls just inside the semicircular hole which partly closed the ventilator shaft.

In the intentionally filled kiva (Room 788) beneath the altar of the main church at Awatovi there were eight globular stones, half of them in fill and half in the horizontal part of the ventilator shaft. At least four had been intentionally ground to shape, and are included with the balls described here, while the other four have been classified as pecking stones because of the battered, unsmoothed surfaces. Actually, their function as pecking stones may have ceased, and the same symbolic or ritual use made of them as of the other balls.

Distribution and Use of Stone Balls in the Pueblo Area. Although stone balls have been found in sites scattered over most of the Southwest, and covering a long time span, any attempt to analyze this distribution brings one up against serious difficulties. The first part of the problem is one of negative evidence. Can a trait reported for a score of sites be regarded as absent at other similar sites where it is not mentioned in reports? In the case of an item like stone balls this is probably not a safe assumption. A good deal of our archæological reporting has been so sketchy that only the most "interesting" or "significant" traits are included, or, with even less justification, those in which the author is personally interested. The second problem is semantic. As a descriptive term "ball" has been too loosely used to have much meaning if no definition or qualification is added. The numerous "balls" reported seem to include a good many pecking stones, unworked concretions, etc., so that their mere listing in site reports is often impossible to evaluate. Because of this, it has been impossible to determine where or when objects similar to the balls reported here were in use.

There are numerous uses to which stone balls may have been put. Without a complete survey of ethnographic reports on the Pueblos, the following list cannot be considered more than suggestive.

1. Sling stones (Bandelier, 1890, p. 154. Hewett, 1938, p. 132. J. Stevenson, 1883, p. 441)
2. Imitation of thunder, by rolling stones on kiva floor (Bunzel, 1932, p. 491. Parsons, 1939, pp. 378, 981. J. Stevenson, 1884, p. 526)
3. Clubs with buckskin cover and wooden handle (Hough, 1903, p. 338. Cummings, 1940, p. 53)
4. Badges of authority, probably also clubs (Fewkes, 1898a, p. 625)
5. Games (Hough, 1914, p. 21)
6. Kicking stone for races (Hough, 1915, p. 107. Parsons, 1939, p. 620. Titiev, 1938). Gum covered, for kicking races (Spier, 1933, p. 334)
7. Cup and ball game (Hough, 1915, p. 107)
8. Hidden ball game (Roberts, 1940, p. 125. Culin, 1907, p. 357)
9. Weight in dye pot (J. Stevenson, 1884, p. 526)
10. Pecking stone (Kluckhohn and Reiter, 1939, p. 60, note)
11. Fetishes, probably only concretions (Parsons, 1936b, p. 598)

Without careful examination of the specimens and consideration of the conditions under which they were found, assignment of any of these functions must be guesswork. For the Jeddito stone balls the uses that seem most probable are in kicking races, to imitate thunder, and as clubs.

Stones rolled across a kiva floor to imitate thunder, presumably at a significant moment in a ceremony, would have to be large enough to be heard. A good many of the larger balls at Awatovi seem to be suitable. The probabilities of such a use are greatly increased by the finding of stone balls in three of the kivas, in the ventilator openings of two and in a cache in the other. Actual reports of such an imitation of thunder come only from Zuñi and Ácoma, and the trait has not been reported for the modern Hopi.

There is no very good archæological evidence for the use of stone balls as clubs. Fewkes states, in connection with balls he dug up at Awatovi, "there were many spherical stones, resembling those still sometimes used in Tusayan on important occasions as badges of authority. These stones were tied in a buckskin, which was attached to a stick and used as a war club."[1] In this connection it is helpful to have the record made by Gifford in his culture-element survey.[2] Item 1207 is "Clubs: stone and stick encased in rawhide," and is listed as present at San Ildefonso and sometimes present at Walpi, in addition to nine of the Navaho and Apache groups. The Beagleholes' account of Hopi warfare definitely states, of the warclub, that the "stone head was wrapped in buckskin."[3] There is a possibility that some of these clubs were grooved, but with a covering of hide it would probably not be necessary. None of the Jeddito stone balls were found under circumstances that indicated they had been clubs, but since the trait is reported for the Hopi, the possibility remains.

It is well known that the Hopi, like many other Southwestern tribes, engage in races which often involve kicking an object along the ground. One of the Hopi workmen at Awatovi thought the stone balls of about 4 to 6 centimeters in diameter were probably made for kicking races. Culin[4] describes balls of wood, of stone and of horsehair with a pitch binder used by the Hopi in kick-ball races. The stones he refers to were of "serpentine" and of concretionary sandstone, about 2 to 2⅜ inches in diameter (5 to 6 centimeters). Hough says that "stones are carried on top of one foot" in kicking races,[5] and tossing seems to be a better term than kicking, since the stone was usually lifted onto the instep and tossed or thrown foreward with a motion of the foot. Titiev mentions that they are "somewhat smaller than tennis balls, are made either of piñon gum or of sandstone with the edges bevelled."[6] Balls of soft material, such as pitch and hair could, of course, actually be kicked. Without direct evidence, it seems at least highly probable that some of the Awatovi stone balls were for kicking races. Possibly some from the cache with the stone mountain lion were for such a purpose, since races were held in connection with ceremonies, and the equipment might have been kept in a kiva.

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[1] Fewkes, 1898a, p. 625.

[2] Gifford, 1940, p. 32.

[3] E. and P. Beaglehole, 1935, p. 20.

[4] Culin, 1907, p. 678 ff.

[5] Hough, 1915, p. 107.

[6] Titiev, 1938, p. 36.

For the hidden ball game only a very small stone would be suitable, as it had to be concealed under a small wooden cup or cylinder. Those described by Culin would not cover an object more than 2 centimeters in diameter.[7] Hough describes those used by the Hopi in their games as "about the size of a marble."[8] However, at Whitewater Ruin the Zuñi workmen insisted that the sandstone balls of 3.3 to 4.0 centimeters diameter were designed for a hidden ball game.[9] Their game was probably played without the small cups that the Hopi use at present. Whether any of the Awatovi balls were used in some such game must be left a matter of conjecture.

Stones used in slings would hardly need to be as carefully shaped as are these stone balls. The sling is reported as a Hopi trait in Gifford's survey, as a boy's toy, for bird killing, for crop protection and for war.[10]

In conclusion, then, there is some indirect evidence that at Awatovi stone balls were used to imitate thunder, and there is a possibility that they were used in kicking races and as clubs. Other uses are not impossible, but far less likely.

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[7] Culin, 1907, pp. 358–64.

[8] Hough, 1915, p. 107.

[9] Roberts, 1940, p. 125.

[10] Gifford, 1940, p. 33, items 1220–1223.

STONE PIPES

General Remarks. Although only seven stone pipes were found, all of them tubular, they span the entire duration of the Jeddito sites under consideration, from Basket Maker III to the 17th century. They are of fine sandstone and red shale, and from 3.4 to 10.4 centimeters long. There is no direct evidence that they were used for smoking, either of tobacco or other herbs, but their similarity to pipes used elsewhere for tobacco makes it reasonable to assume such a use. Pipes of pottery were far more abundant, but are beyond the scope of this report.

Description. Figure 36, *a*, a slightly tapered cylinder, ground smooth. Smoke blackened on outside, and interior filled with hard burned material. Length 10.4 centimeters, maximum diameter 2.3 centimeters, bore tapers from 2.1 centimeters to 1.2 centimeters diameter. Fine-grained sandstone. Site 264.

Figure 26, *b*, tapered, with two flanges 2.0 centimeters long, each deeply notched. Surface poorly smoothed, with scraped and scratched appearance, stained dark from dirt and grease. Inside drilled with 1.0 centimeter cylindrical bore at large end, 0.3 centimeter bore for small end. Length 6.8 centimeters. Light red shale, softer and less compact than the red argillite used for ornaments. Awatovi Pueblo IV, found in 11 fragments in rubbish.

Figure 36, *c*, fragment of a conical pipe with interior diameter 0.7 centimeter. Exterior ground smooth, both ends missing. Fine-grained sandstone. Site 108.

Figure 36, *d*, tubular fragment, exterior highly polished. Interior shows striations of four successive cylindrical drills, each slightly smaller than its predecessor. All were inserted from lower end, and were at slight angle to long axis of pipe. Upper end missing. Walls are 0.3 to 0.1 centimeter thick. Red argillite. Awatovi Pueblo IV.

Figure 36, *e*, tubular fragment, both ends missing, outside highly polished. Interior drilled at slight angle to axis, with uniform diameter. (The tapered appearance in the photograph is due to the angle at which the pipe is split.) Red argillite, resembling material from Del Rio quarry near Prescott. The whitish inclusions about 0.2 centimeter in diameter and the granular surface of fractures distinguishes it from all other red argillite objects from Jeddito sites. Awatovi Pueblo V.

Figure 36, *f*, a carefully shaped piece of limestone with a round-bottomed hole begun at the larger end, of 1.3 centimeters diameter and 0.8 centimeter depth. A similar object of red argillite, with slightly flattened cross-section, has the surface faceted by grinding and has a rounded hole 1.2 centimeters in diameter at one end. These may be unfinished pipes, although this is only a guess. Both Awatovi Pueblo IV.

Material.	Fine-grained sandstone	2
	Red argillite	4
	Limestone	1
Provenience.	Site 264, BM III-early P I	1
	Site 108, P II-III	1
	Awatovi, P IV (Y-17)	4
	" P V (17c)	1
	Total	7

Distribution of Pipes in the Pueblo Area. The majority of stone or pottery pipes in the Southwest are simple tubes which taper to a greater or lesser degree. The shortest and most tapered are called "conical." Such pipes are characteristic of Basket Maker II and III sites, and persist into Pueblo IV and V. The fragments from Jeddito Site 108 (Pueblo II-III) appear to be of this type. The term "tubular" is generally applied to pipes with little or no taper; very few of them are true cylinders. Rinaldo suggests that the thick tubular pipe with a separate stem of bone or wood is characteristic of only the Mogollon Culture in the 8th century.[1] The available data seem to support this, and also indicate that this style of pipe spread north to the Kiatuthlanna pithouses (Pueblo I),[2] to Whitewater (Pueblo I-II),[3] and to the Pueblo III-IV sites in the Petrified Forest district (Canyon Butte, Metate Ruin, Milky Wash),[4] and the Scorse Ranch north of Holbrook.[5] Similar pipes are illustrated in West's enormous catalogue of Indian pipes, from "Pueblo ruins, Apache County," "near St. Johns," and "Taos ruin,"[6] and from Pueblo Grande de Nevada.[7]

It is possible that the more slender tubular pipes of the Jeddito area are related to this Mogollon and Little Colorado type. Pipes such as that from Jeddito Site 264 (Basket Maker III) are common in both stone and pottery over most of the Pueblo region, although generally of later date. Simple tubular pipes are also characteristic of California, and occur scatteringly over the entire United States, according to West's survey.[8]

The Awatovi flanged pipe (fig. 36, *b*) is suggestive of New Mexico pottery pipes, although simpler than any of those illustrated in the Pecos report.[9] A longitudinal flange or keel forms part of the elaborate modelling on many of these pipes, but all of them also have features absent on the Awatovi specimen, namely, flattened mouth-pieces and incised decoration on a central zone of square cross-section. Generally, such decoration is lacking on Southwestern stone pipes, although present on many of pottery.

No stone elbow pipes were found in the Jeddito sites, although they are occasionally found in Pueblo III and IV sites elsewhere,[10] and were made by the Hopi during the 19th century.[11]

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[1] Rinaldo, 1941a, p. 13.

[2] Roberts, 1931, p. 159, pl. 40, *a*, *c*, *d*.

[3] Roberts, 1940, p. 121, pl. 32, *c*, *d*, *f*.

[4] Hough, 1903, pp. 311, 317, 319–20.

[5] Hough, 1903, p. 309.

[6] West, 1934, pl. 23, fig. 4–6.

[7] West, 1934, pl. 26, fig. 1.

[8] West, 1934, Map 1, p. 360. Unfortunately this very extensive but uncritical compilation is almost entirely geographical in nature, with little reference to chronology or to generally recognized historic or prehistoric culture units.

[9] Kidder, 1932, p. 158.

[10] Rinaldo, 1941a, pp. 204–06.

[11] Voth, 1901, pl. 40.

COOKING SLABS

Description. Fine-grained sandstone slabs with one very smooth surface which is stained with grease, see figure 38. The under side shows the effects of heat. It is believed that these slabs were used in cooking, probably for a wafer bread similar to the modern Hopi "piki" which is made on identical slabs.

Shape. Roughly circular (9), subrectangular (4), irregular (4). Others fragmentary. The three from Site 104 and Pink Arrow are all irregular.

Size. Diameter of circular slabs 35 to 50 centimeters. Two subrectangular slabs 28 by 40 centimeters and 16 by 20 centimeters, others incomplete. Irregular slabs range in length from a minimum of 15 by 18 centimeters, to a maximum of 30 by 40 centimeters. Thickness: mean 3.2 centimeters, maximum 4.6 centimeters, minimum 1.8 centimeters.

Material. All are of very uniform fine-grained sandstone, red, gray or yellow.

Provenience.	Site 104, P II-III	1
	Pink Arrow, P III-IV	2
	Awatovi, P IV (Y-17)	3
	Awatovi, P V (17c)	15
	Kawaika-a, P III-IV	1
	Total	22

All but one in rubbish fill:

Pink Arrow Room 2, slab standing against east wall. Not in place for use, but there was a fireplace along south wall.

Cooking Slabs in the Southwest. These specialized stone slabs for cooking wafer bread appear in the Pueblo region at several widely scattered points in Pueblo III. They are unknown along the Mogollon Rim, with a single exception, and are absent from the Hohokam Culture. The following cooking slabs have been reported:

Eagles Nest House, Colorado (Morris, 1919, p. 177)
Step House, Mesa Verde (Rinaldo, 1941a, p. 78)
La Plata District, Pueblo III (Morris, 1939, pp. 98, 99, 108. They are referred to as "comals," a term better applied to the Hohokam clay griddles)
Luna Pit House (Hough, 1920, pp. 410, 418)
Aztec (Morris, 1924, p. 240)
Unshagi (Reiter, 1938, p. 164)
Nanishagi (Reiter, Mulloy and Blumenthal, 1940, p. 31)
Puyé (Hewett, 1938, p. 80)
Poseuinge (Jeançon, 1923, p. 24)
Pecos (Kidder, 1932, p. 75)
Rowe Ruin (Kidder, 1932, p. 75)
Tijeras Canyon, near Albuquerque, New Mexico (personal communication, Carroll Burroughs, University of New Mexico)

These cooking slabs were probably used much as they are today, since most of them have been deeply stained with grease and are blackened on the rougher under side. This kind of slab is especially suitable for making a very thin wafer bread (Hopi "piki," Zuñi "wiavi," etc.). The liquid batter is spread thinly with a sweep of the hand, and almost immediately is cooked and begins to curl up from the greased stone. There are good accounts of this process at the Hopi towns of Walpi, Mishongnovi and Oraibi,[1] and an excellent photograph of a piki-slab in use appears in "The Hopi Way" by Thompson and Joseph.[2] Similar stones are used, or were until recently, at Zuñi,[3] Jemez,[4] Santa Clara,[5] and probably at other eastern Pueblos. The Havasupai have a similar slab on which wafer bread is baked, a trait probably acquired from the Hopi.[6] No other non-pueblo tribes, as far as I know, have adopted the custom.

Several accounts of Hopi and Zuñi cooking slabs emphasize the extreme care necessary in quarrying, shaping and installing them. As Beaglehole points out, the process "is considered both delicate and difficult. By paying attention to definite rules, the worker gains a feeling of confidence which is the more valuable the less control she has over the ultimate outcome of her labor."[7] At Oraibi special quarrying trips are planned many months ahead, and the material must be obtained from one of the two traditional sources. The final installation is in secret, by one of a few expert women, and "once in place these utensils are seldom or never removed to other quarters and inheritance implies the right of use rather than actual possession."[8] Although comparable secrecy and care are exercised at Zuñi, the manufacture is less ritualized at Jemez where they are an object of trade. Whether any special restrictions applied to their making in prehistoric times is, of course, not known. But at the present time it is indicative of their importance in the pueblo economy, and the special skills needed for their manufacture, that they should be subject to such special attitudes and restrictions, in spite of their basically utilitarian nature.

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[1] Parsons, 1936b, pp. 1195–97, fig. 529. E. Beaglehole, 1937, pp. 58–59. Titiev, 1944, pp. 197–98. Curtis, 1922, p. 43.

[2] 1944, p. 128.

[3] Cushing, 1920, pp. 317–43. J. Stevenson, 1883a, p. 343.

[4] Parsons, 1939, p. 35.

[5] Robbins et al, 1916, p. 93.

[6] Spier, 1928, p. 116.

These stone cooking slabs, which are characteristic of the modern Pueblos, and of some the prehistoric Pueblos at least since the 12th or 13th centuries, are unknown in the Gila-Salt basin, where flat clay griddles ("comales") are used by the Pima today,[9] and are found in Hohokam sites of the Classic Period.[10] Haury states that neither stone nor clay baking slabs have been found in Hohokam Colonial and Sedentary Periods, and states that "this may be taken as an indication that the tortilla-like article of diet had not yet become a part of the daily fare."[11] It is suggested that flat "pancakes" of dough were cooked on these clay griddles, as is now done by the Pima. Their surfaces are not sufficiently smooth to allow the use of the liquid batter from which the Pueblo wafer bread is made.

What is the significance of the nearly simultaneous appearance of these similar, but distinct cooking methods in two parts of the Southwest? Although Haury suggests a southern origin for clay griddles they do not appear to be appreciably earlier in the Valley of Mexico than in Arizona. "The circular roaster or griddle for cooking tortillas came in with Mazapan culture and continued to be popular through Aztec times."[12] A date for the Mazapan Culture has been suggested as 12th to 13th centuries.[13] Still further south, in the Guatemala highlands, clay griddles were in use much earlier, commencing near the beginning of the Christian Era[14] or even earlier. Between the Valley of Mexico and southern Arizona there are insufficient data to demonstrate either a continuous distribution or two discrete concentrations of the trait. Even granting a southern origin for the trait, and its rapid spread into southern Arizona, it is difficult to see clay griddles giving rise to stone cooking slabs. Both in the artifacts and in the cooking methods involved there are great differences. Stimulus diffusion would be a convenient concept to fall back on, but even this is not entirely convincing. According to the recent estimates by Gladwin for Hohokam dates, the clay griddles would appear slightly *later* than the inauguration of stone cooking slabs to the north. Furthermore, an independent northern invention is favored by the absence of both traits at sites along the Little Colorado and Mogollon Rim, with the exception of Luna Pit House.

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[7] E. Beaglehole, 1937, pp. 58–59.

[8] Titiev, 1944, p. 198.

[9] Russell, 1908, pp. 129, pl. XIX, *b*.

[10] Haury, 1945a, pp. 109–111, fig. 67, pl. 28.

[11] Haury, 1945a, p. 109.

[12] Vaillant, 1944, p. 151.

[13] Vaillant, 1944, p. 79. Vaillant, 1938, p. 554.

[14] Kidder, Jennings and Shook, 1946, p. 208.

VARIOUS ARTIFACTS, MOSTLY OF UNKNOWN USE

WEIGHTS (?)

GROOVED WEIGHTS (?)

FIGURE 39 *a–c*.

Definition. These are crudely grooved pieces of sandstone, tentatively called weights. They appear more suitable for this purpose than any other.

Description. The encircling grooves are narrow, 0.7 to 1.2 centimeters, and very shallow. The objects vary from extremely irregular, with little attempt at shaping, to nearly spherical with the surface ground smooth. The smaller specimens are the more carefully shaped. Figure 39, *c*, has two grooves, perpendicular to each other, both very shallow. All others have a single groove. The largest one found is from Site 264, and is shaped by pecking to a crude oval with nearly circular cross-section. The resemblance to full grooved hammers is only superficial, as the grooves are smaller and cruder, shapes are irregular and variable and the material is too fragile.

Size. Length, mean 8.0 centimeters, maximum 15 centimeters, minimum 3 centimeters. Most of them are between 5 and 10 centimeters in length.

Material. Sandstone, fine- to coarse-grained, poorly cemented and very crumbly, and hence easily worked.

Provenience.		
	Site 264, BM III-early P I	1
	Pink Arrow, P III-IV	3
	Awatovi, P IV (B/Y)	7
	" P IV (Y-17)	6
	" P V (17c)	9
	" Unassigned	2
	Total	28

Three come from the cache in the southwest corner of the kiva, Test 14, Room 5, where there were a large number of stone balls and a carved mountain lion.

NOTCHED WEIGHTS (?)

Figure 29, *d*, is a piece of vesicular basalt, carefully shaped, with well made notches in four sides. It shows no evidence of having been used for pounding. Length 13 centimeters. Provenience, Awatovi Pueblo V (17c).

DISCUSSION OF WEIGHTS

The function assigned to these objects is wholly speculative, and almost no artifacts like them have been found elsewhere. In a kiva at Waterfall Ruin, on the Chinlee River (Basket Maker III-Pueblo I), two objects were found with string and yucca tied around them as though they were to be suspended. One was a fragment of adobe and the other a piece of sandstone notched on four sides. Kidder and Guernsey suggested that they may "have been weights connected in some way with the process of weaving."[1] Unfortunately, no accounts of modern weaving include any processes in which such weights might be used. The United States National Museum collections contain two grooved sandstone objects[2] found by Fewkes at Sikyatki. They closely resemble the grooved weights described here. Fewkes does not mention them in his report, but he tells of another grooved "weight," "a rough stone, not worked save in an equatorial groove. This object is too heavy to have been carried about."[3] He suggests that it might have been for tethering captive eagles, although no special stones are needed at present by the Hopi for tying up eagles. The only other reported occurrence of such a grooved object is at Alkali Ridge in Pueblo II, an irregular piece of sandstone with a narrow groove, and with little evidence of use for pounding.[4] Until more data become available, either ethnographic or archæological, no conclusions can be reached regarding the use of the objects.

The single "notched weight" is closely duplicated by an oval stone with four notches that was acquired somewhere in northeastern Arizona by Major Powell, during his explorations in the 19th century.[5] This and the Awatovi specimen are more carefully notched and better shaped than would be necessary merely to secure a suspension cord. Although clubs with four notches for fastening the handle are unknown, this would be another possible use, since both specimens are of igneous rock and quite heavy.

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[1] Kidder and Guernsey, 1919, p. 125, pl. 51, g.

[2] Catalogue numbers 156 203–4.

[3] Fewkes, 1898a, p. 731.

[4] Brew, 1946, fig. 51, *h*.

NOTCHED DISK

Figure 39, *e*, is a roughly shaped disk of coarse sandstone, with five deep notches regularly spaced around the edge. It may have been used for abrading, as the notches would be suitable for small wooden objects. It might also have served some symbolic function in Hopi ritual. Diameter 7 centimeters, thickness 3 centimeters. Awatovi Unassigned.

STONE WITH ANNULAR GROOVE

Figure 39, *f*, is an irregular block of sandstone, approximately flat on one surface in which is ground a circular groove 0.7 centimeter wide with a maximum depth of 0.5 centimeter and an outside diameter of 7 centimeters. Another groove, straight, extends down one corner of the block from this circular groove. Material, a poorly consolidated, fine-grained yellow sandstone. 12 by 11 by 9 centimeters. Awatovi Pueblo V (17c).

FLAT POLISHED PEBBLE

Figure 39, *g*, is a smooth, waterworn pebble of reddish quartzite. It would not be worth noting, except that it was found under the jaw of Burial 92 in the Baptistry of Church 2. The burial was an adult, probably male, and was accompanied by several wooden prayersticks, some red pigment, and a bone wrist ornament. Except for two narrow zones of polish on a long edge and one face, the pebble shows no evidence of use. The size and position of the polished areas suggests some long continued use in rubbing, probably on a relatively soft material such as wood or leather. 14 centimeters long. Awatovi Pueblo V (17c).

JAR LIDS (?)

Figure 39, *h–k*.

Description. Stone disks, shaped by grinding, but not completely smoothed. The larger two have somewhat irregular edges and only one smoothed face. The smaller two are more completely smoothed. Diameters 9, 10, 14 and 18 centimeters. Thickness 1.0 to 1.5 centimeters. Material, fine-grained sandstone (3), quartzite (1).

Provenience. Awatovi,	P III (B/W)	1
”	P IV (B/Y)	2
”	P V (17c)	1
Total		4

Discussion. The finding of only four stone disks that might have served as jar lids is surprising. They span the whole occupation of Awatovi, but no other sites are represented. Similar disks are known from Pueblo II and III sites in the Mesa Verde, San Juan, Kayenta and Chaco areas. Only a few Pueblo IV sites have yielded jar covers of stone, Kintiel, Awatovi, Hawikuh, Poseuinge and Pecos.

Although jar lids have been found in place at several sites, thus justifying the use of the term, other purposes are also known for such disks. Roberts found a "sipapu" (symbolic hole in the floor of a kiva) covered by a stone disk at the Village of the Great Kivas.[6] At Zuñi there are two games in which stone disks 2 to 5 inches in diameter are used. In one a disk with one side painted red is thrown up to decide which team will start the hidden ball game.[7] In the other, stone disks are balanced on a corn cob standing on end as a target in a throwing game.[8]

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[5] U. S. National Museum collections, No. 70 198.

[6] Roberts, 1932, p. 144.

GROOVED CHALK OBJECT

Figure 39, *l,* is a semicircular piece of soft white chalk, with the curved edge thin and the straight edge thick. It is nearly worn through by a deep groove, along which it has broken. Its use is unknown. Length 8 centimeters. Awatovi Pueblo V (17c).

POLISHED "CELT"

Figure 39, *n,* was found in two pieces, in rooms some distance apart, both on the north side of the 17th century plaza adjoining the mission at Awatovi. United, the two fragments form a short, slightly tapered blade, oval in cross-section. It is polished all over to a high gloss, except where broken and on the chipped and battered ends. It is shorter and thicker than the tcamahias, so that the term "celt" seems the most suitable. Prior to breaking, a narrow groove was worn in it, with V-shaped cross-section, such as might result from an attempt to cut it in half lengthways. Material, a hard green stone. Size, 9.5 by 5.0 by 1.6 centimeters. Awatovi Pueblo V (17c).

REWORKED AXE BLADE

Figure 39, *o,* appears to be an axe blade which has been broken away from the poll, through the groove. The surface of the bit is carefully smoothed and covered with fine striations, mostly lengthways. What remains of the groove is roughly pecked, not smoothed as was usual in grooved axes. It is pecked so deeply that the intention may have been to break it in half. The cutting edge has been carefully sharpened. Two deep V-shaped grooves, directly opposite each other, extend the length of the bit. Each is worn about a quarter of the way through, probably in an unfinished effort to saw the implement in half in order to use it for making something else. The material is a fine-grained deep red stone, possibly argillite. Size, 11 by 7 by 4 centimeters. Awatovi Pueblo IV (Y-17).

PICKS (?)

Figure 35, *n–q.*

Description. Crude, elongated tools, worn smooth on one or both ends. Their shape is the result of selection of naturally slender slivers of basalt. There has been little attempt to modify their shapes, but three are somewhat smoothed all over, as though from long handling, or rubbing off the sharp edges. Three are more triangular than elongated, with pointed end worn and polished. Four are slender and worn on both ends.

Use. Uncertain, but might have served as tools in quarrying or as crude hoes. They were probably used in the hands, without handles, as there are no notches or grooves for hafting.

Size. Length from 13 to 22 centimeters, width or thickness 4 to 11 centimeters.

Material. Basalt.

Provenience.

Site 108,	P II-III	1
Awatovi,	P IV (B/Y)	1
"	P IV (Y-17)	2
"	P V (17c)	1
"	Unassigned	2
Total		7

Discussion. The term *pick* has been so variously used by archæologists that it is almost meaningless. Gebhard suggests a broad definition covering tools 3 inches or more in length, with one pointed end, with hafting method unspecified.[9] I would limit the term to tools, either hafted or held in the hand, not flat bladed enough to have served as hoes, but large and strong enough to break or pierce hard earth and rock. Almost none of the "picks" described in archæological reports on the Southwest would be included in such a definition, as they are more like pestles, axes, hammerstones, hoes, etc.

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[7] Culin, 1907, p. 382, fig. 500.

[8] Culin, 1907, p. 726, fig. 950.

Picks, in the limited sense used here, were found at the Camp Verde salt mines,[10] carefully shaped by pecking. They had a three-quarter groove for hafting, similar to axes and hammers of the area. There were also larger tools, crudely pecked to a point at one end, which were probably used in the hands without hafting. Both types of pick were used in mining salt. Similar tools are said to have been used by the early Hopi coal miners and have been found occasionally by modern Hopi miners of Second Mesa.[11] These Hopi picks were full-grooved, like the mauls that are said to have been used in breaking out the coal and cracking off the overburden. The prehistoric coal mines investigated by the Peabody Museum Awatovi Expedition yielded no picks, and but a single large quartzite hammerstone, although numerous potsherds were found that had apparently been used to scrape back the loose dirt and rock.[12] Whether the picks found at Site 108 and Awatovi were used in coal mining is uncertain, but in cramped quarters in the trenches or tunnels of the coal mines they would have been very useful implements. Hopi coal mining began in late Pueblo III, in the 13th century,[13] and none of the picks found antedate this beginning.

These picks may have been used for other purposes besides mining, such as excavating and dressing sandstone for building. Being rough and unspecialized tools they probably served a variety of purposes as the occasion arose, but none in which they were indispensable.

SMALL ROUGH CYLINDRICAL STONES

FIGURE 40, *a–g*, *j*, *k*.

Description. Elongated stones with rough surfaces, cylindrical (20) or slightly flattened (8), with rounded ends. They appear to be intentionally shaped by pecking, and the flattening of a few may be due to wear from some unknown abrasive use.

Size. Length 11 to 6 centimeters. Diameter 4 to 1.5 centimeters.

Material. Coarse quartzitic sandstone (24), vesicular tuff (4). The latter are from Awatovi Pueblo III (3) and Pueblo IV (1).

Provenience.	Site 108, P II-III	1
	Pink Arrow, P III-IV	1
	Awatovi, P III (W-O)	3
	" P III (B/O)	3
	" P IV (O-Y)	5
	Awatovi, P IV (B/Y)	11
	" P V (17c)	3
	" Unassigned	1
	Total	28

Discussion. These artifacts, although never very numerous, are most plentiful in Pueblo III at Awatovi, comprising 1.3 per cent of the total stone artifacts of the period, as compared to 0.6 per cent of the total in Pueblo IV and 0.1 per cent in Pueblo V. Similar objects occur in sites of the Flagstaff area which are contemporary with late Pueblo II and with Pueblo III in the Jeddito.[14] They are also relatively common in the Verde Valley in Pueblo III and IV (Tuzigoot and King's Ruin, and various unexcavated sites.)[15] They have been found in one Pueblo IV site in the Petrified Forest (Stone Axe Ruin).[16] They thus seem to be mainly limited to a zone from the Verde Valley across the Little Colorado River to the Jeddito district, suggesting some contact between these areas during Pueblo III and perhaps Pueblo IV.

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[9] Gebhard, 1946, p. 498.

[10] Morris, 1928a.

[11] Colton, 1936, p. 60.

[12] Hack, 1942b, pp. 11–12.

[13] Hack, 1942b, p. xi.

[14] Pittsberg Village (NA 3577), Wupatki (NA 405), Ridge Ruin (NA 1785) and Juniper Terrace (NA 1814), H. S. Colton, personal communication.

[15] Bartlett, 1934, p. 26. Spicer, 1936, p. 58. H. S. Gladwin, personal communication.

[16] Hough, 1903, p. 322.

Numerous uses have been suggested for these artifacts. None of them sound fully convincing, but I list them for what they may be worth.

1) Tokens carried by runners in relay races, in the manner of the Hopi today.

2) Rubbed against ears of corn for shelling.

3) For smoothing plaster.

4) Toy manos for little girls learning to grind corn, as small grinders for pigments, etc.

5) Phallic symbols.

6) Abrasive tools for woodworking and possibly also smoothing of sandstone objects.

THICK CYLINDRICAL STONES

Figure 40, *p–u.*

Description. Ground to an approximately cylindrical shape, with length about the same as diameter. Figure 40, *t,* has two faintly incised lines encircling it lengthways. All are smoothed on both ends, as well as sides. One was found with a burial (No. 79) in Church 2 at Awatovi.

Size. Largest is 6.8 centimeters long, 5.7 centimeters in diameter. Smallest is 3.0 centimeters long, 2.4 centimeters in diameter.

Material. Fine-grained sandstone.

Provenience.	Site 108, P II-III	1
	Pink Arrow, P III-IV	2
	Awatovi, P III (B/W)	1
	" P III (W-O)	1
	" P III (B/O)	2
	" P IV (B/Y)	1
	" P IV (Y-17)	1
	Awatovi, P V (17c)	2
	Total	11

Discussion. Although some of the abrading stones of fine-grained sandstone were worn down to globular, almost cylindrical shapes, none were as symmetrical as these objects, which seem to have been shaped intentionally, not incidentally to use. As far as I know, there are no objects like these used on Pueblo "altars," but they would not look at all out of place in those assemblages of pebbles, carved animals, bowls, feathers and sticks. The complexity of Pueblo symbolism makes it entirely possible that some paraphernalia used in the past lacks any modern duplicates.

Some of the small cylindrical objects at Whitewater (Pueblo I-II) are quite similar to the Jeddito examples,[17] and an identical object was found at Puyé.[18]

SMALL TAPERED STONES

Figure 28, *m, u, v,* and 32, *d, e.*

Description. Figure 32, *d, e,* are a pair of fine-grained white sandstone objects found at Site 111. They have been ground to their tapered shape, leaving a series of facets on the surface. Lengths are 4.3 and 3.2 centimeters.

Figure 28, *u,* is one of two similar objects, ground from fine-grained schistose rock. Their large ends are not smoothed, but both taper to a blunt point at the small ends.

Figure 28, *v,* is of highly polished hard stone, apple green in color, with one end broken off. It comes from the 17th century fill of the main church at Awatovi.

Figure 28, *m,* is one of two small objects that may be of natural origin, the result of weathering. The one not illustrated is of the same shape, but less polish; it is stained and dirty, partly smoothed as though from handling or carrying in a pouch.

Provenience.	Site 111, P II	2
	Awatovi, P IV (Y-17)	1
	" P V (17c)	4
	Total	7

Discussion. The purpose for which these small ground or polished objects were made is unknown, but the care and effort devoted them suggests that they were made for some definite purpose. A few similar objects have been found elsewhere, at Pecos,[19] Tuzigoot,[20] Winona or Ridge Ruin,[21] and Poseuinge.[22] None were found under circumstances giving any clue to their use. It is possible that they were charms or fetishes, and were regarded by the Indians the way fossils and concretions were.

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[17] Roberts, 1940, pp. 121, 125, pl. 32, *e.*

[18] Collections of Museum of New Mexico, Santa Fé.

SLENDER POLISHED CYLINDRICAL STONES

Figure 28, *o–t*.

Description. Ground and polished cylinders of unknown use. They are ground in a series of longitudinal facets which have not been entirely obliterated except in the most highly polished specimens. The ends are ground square and polished as well as the rest of the surface. There are no indications of wear, no perforations, and no signs that they were fastened to other objects. Figure 28, *p* (4.7 centimeters long, 1.6 centimeters in diameter) was found beside the leg of a skeleton (No. 15 in Test 24, Square E) but there is nothing to suggest how it might have been worn or fastened to the costume. This burial is just east of the entrance to Church 2 and may belong to Pueblo IV or V.

Size. Mean length 4.2 centimeters, mean diameter 1.0 centimeter.

Material.	Dense red-brown stone, unidentified	5
	Massive gypsum	1
	Quartzite	1
	Igneous	1
	Dense green stone, unidentified	1

Provenience.	Awatovi,	P III (B/W)	1
	"	P IV (O-Y)	1
	"	P IV (B/Y)	1
	"	P IV (Y-17)	1
	"	P V (17c)	2
	"	Unassigned	3
	Total		9

Use and Occurrence. If the overworked expression "ceremonial" can be applied to any of the Jeddito artifacts, these slender polished cylinders deserve it. They exhibit care and considerable effort in manufacture, and no utilitarian purpose is apparent. Morris lists similar polished cylindrical rods as "paint cylinders" but adds, "It is evident that the finished cylinders were shaped for a definite purpose and were not intended to serve as a further source of pigment."[23] The Jeddito examples include no materials suitable for pigment, unless possibly the gypsum. Nearly all the objects of this sort reported (with details) from Southwestern sites were in burials, but without indication of just how they might have been worn, carried, contained or otherwise associated with the dead.

One possible function is a nose plug. There are three reasons to suspect that they may have been worn through a slit in the nasal septum. First, a wooden nose plug of the same shape, a simple cylinder, was found in place on a burial in Ventana Cave, assigned to the Hohokam Sedentary or Classic Period.[24] Second, nose plugs of a more elaborate type with flanged ends or a constricted center are a Hohokam trait appearing at Snaketown around A.D. 1000.[25] Third, a nose plug was found in place on a burial at Ridge Ruin near Flagstaff, of a date corresponding to Pueblo III. It is curved with enlarged ends but other objects found at the site and believed to be nose plugs also include simple curved and straight rods.[26] This is slim evidence for determining the use of the Jeddito specimens, particularly since none were found in place, but it is at least suggestive. It might be that at the northern limits of this trait's spread the original function survived in only an occasional use at rare intervals.

Cylinders very much like the Awatovi ones are reported at the following sites, in addition to those mentioned above:

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[19] Kidder, 1932.

[20] Caywood and Spicer, 1935, p. 85.

[21] McGregor, 1941, p. 192, fig. 66H.

[22] Jeançon, 1923, p. 22.

[23] Morris, 1939, p. 131.

[24] Haury, 1950, p. 421.

[25] Haury, 1945b, p. 64.

[26] McGregor, 1941, pp. 204–09. McGregor, 1943, p. 280, pl. II (fig. 4), fig. 11.

Mesa Verde (Nordenskiold, 1893, pl. 51, no. 8)
La Plata Site 41, Pueblo III graves only (Morris, 1939, p. 131, fig. 141)
Cannonball Ruin, Colorado, Pueblo III (Morley, 1908, p. 607, pl. XXXIX, *l, m*)
Aztec Pueblo, Pueblo III (Morris, 1919, p. 27, fig. 14, *a*)
Pueblo Bonito, Pueblo III (Pepper, 1920)
Leyit Kin, Pueblo III only (Dutton, 1938, p. 70, pl. V, *a*)
Coolidge Village, early Pueblo II (Gladwin, 1945, pl. XXXI, *f*)
Whitewater Village, late Pueblo II or early Pueblo III (Roberts, 1940, p. 129, pl. 48, *c*)
Canyon Butte, Pueblo IV burial ? (Hough, 1930, p. 313)
Pecos, Pueblo IV, nearly all from graves, (Kidder, 1932, p. 92, fig. 68, *c–f*)
Poseuinge, Pueblo IV–V (Jeançon, 1923, p. 66, pl. 56, 1)

SMALL CONICAL STONES

Two small white sandstone cones (fig. 32, *b*, *c*), carefully shaped and slightly faceted from the grinding process, were found together in the fill of Room 428 (Awatovi Pueblo V). The larger is 4.5 centimeters high, 3.5 centimeters in diameter. The smaller is 2.7 centimeters high, diameter 2.1 centimeters.

Their use or possible significance is unknown. No objects like this are known elsewhere. The elaborate equipment of Hopi altars sometimes includes clay cones of about this size and shape in which feathers were stuck.[27] These two stones could have been used in this way only if the feathers were tied to them. Fewkes mentions a "stone cone" representing Germ God as part of the Winter Solstice Mamzrauti Altar,[28] but in the illustration it appears much larger than these cones.

CUPPED STONES

Figure 13.

Description. Spherical or biconical objects with a depression 1 to 3 centimeters deep. Depressions show no wear or polish. Exteriors ground and one (fig. 13, *c*) polished. Figure 13, *a*, and two others, all Pueblo IV, are approximately spherical and less completely smoothed than the others. The hole in figure 13, *d*, is conical, while all the others are rounded.

Size. Diameter 5.9 to 8.0 centimeters. Height 4.3 to 7.6 centimeters.

Material.	Sandstone	4
	Concretion (from sandstone)	2
	Quartzite	1
Provenience.	Awatovi, P IV (Y-17)	3
	” P V (17c)	4
	Total	7

Discussion. The use of these cupped stones is not known, but several possibilities can be suggested. The wear on the lip of one indicates that it might have been used upside down, with wear consequently around the edge of the hole. In this position it might have been used in the hidden ball game, but this is only a guess. The game was played by the Hopi, but the only objects for hiding the ball that have been described are wooden, conical or cylindrical, with the bases concave, and were made in sets or four.[29] Other uses that can be suggested are much less plausible. They would be unsuitable as plume holders on altars, because the bases are so rounded they will not stand firmly, and the holes are too broad and shallow to hold the plumes and sticks that often stand along the sides of Hopi sandpaintings.[30] The cup-shaped depressions lack any sign of the wear that would be expected if they served as the sockets for the upper end of drills, either bow or pump type. For the similar cupped stones found at Pecos no function could be discovered either.[31]

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[27] Parsons, 1936b, p. 739.

[28] Fewkes, 1924, p. 385, fig. 3.

[29] Culin, 1907, p. 357.

[30] Parsons, 1939, pl. XVII, XVIII.

[31] Kidder, 1932, p. 66, fig. 37, *d*.

SPINDLE WHORL (?)

Figure 28, *n*, is a flat disk, carefully smoothed and polished on both faces, and rounded at the edge. A small portion is split off one face. Diameter 5.7 centimeters, thickness 0.7 centimeter. Bi-conical central hole has minimum diameter 0.5 centimeter, and diameters of 0.7 and 0.8 centimeter on faces. Material, dense, red and brown ranging to yellow, possibly a schist, source unknown and not local. Provenience, Kokopnyama (Pueblo III-IV) surface.

Spindle whorls in the Southwest and Central America were generally of clay, either worked down from sherds or modelled for the purpose.[32] Only a few stone objects similar to this one are known, and for some of them the function is a matter of uncertainty:

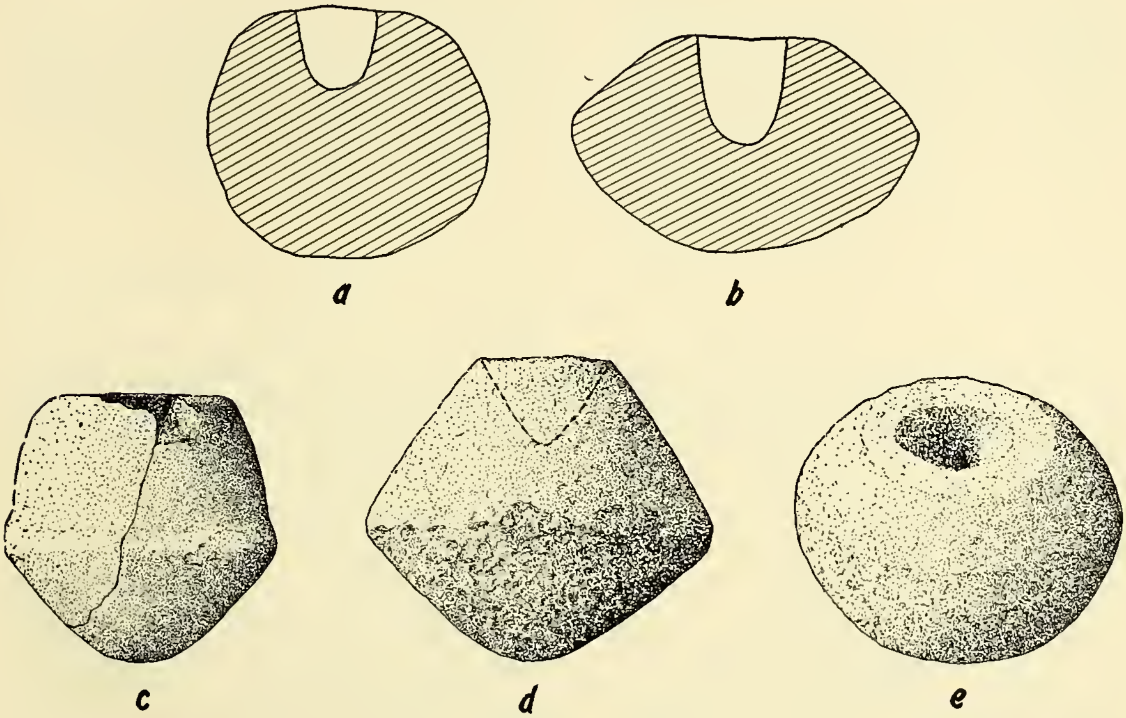

Figure 13

CUPPED STONES

Cupped stones of unknown use. The depressions are all rounded as shown in cross-sections *a* and *b*, except for *d*, which is conical, as shown.

	Provenience			Catalogue Numbers
a,	Awatovi,	Test 19, Room 3, 250–300	Pueblo IV, Y-17	38-120-10/17588
b,	"	Room 476, 100–150	Pueblo IV, B/Y	38-120-10/17585
c,	"	Room 514, 50–100	Pueblo V	37-111-10/11867
d,	"	Room 809, 50–100	Pueblo V	38-120-10/17487
e,	"	Room 778, under floor N end	Pueblo V	38-120-10/17586

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[32] See discussion of types in Haury, 1945, p. 119.

Chihuahua, Mexico (Sayles, 1936, pl. XVII, *c*)
Los Muertos (Haury, 1945, p. 142, pl. 65)
Casa Grande (Fewkes, 1912, p. 129, fig. 32)
Pueblo Viejo (Hough, 1914, p. 74, fig. 153)
Fitzmaurice Ruin (Caywood, 1936, p. 113, pl. LV)
King's Ruin (Spicer, 1936, p. 58)
Kinishba (Cummings, 1940, pp. 51, 54)

On the basis of these few instances, it appears that the objects are not characteristic of the Pueblo area, but might be a Hohokam or Mexican trait which had diffused northward along the Verde Valley route by which other southern traits seem to have travelled. If this were so, the Kokopnyama occurrence would be indicative of southern contacts of the Jeddito district.

PAINTED STONE OBJECT

In the fill of the main church at Awatovi was found a fragment of fine-grained sandstone, originally oval or circular, and probably planoconvex in cross-section. There are the remnants of a thick coat of light green paint on the less damaged portions of the surface, particularly in a shallow groove across the convex face. In its fragmentary condition it is impossible to tell what it may have once been. Possibly it is a fragment of painted carving. None of the carved animals found had paint on them, but modern examples are painted for increased realism.

Size. Present diameter 5.4 centimeters.

Provenience. Awatovi, Pueblo V (17c).

MARBLE SLABS

Three fragments of travertine marble appear to be parts of rectangular slabs about 2.5 centimeters thick. The largest fragment is 12 centimeters across. The source of the material cannot be determined, but it is not local and may be Mexican or European. It is possible that these are fragments of table tops or other furnishings for the church or friary.[33] If so, they were probably broken and thrown away at the time of the Pueblo Rebellion in 1680, when the martyrdom of Spanish priests in Arizona and New Mexico was followed by the destruction of the tangible relics of their activities. Spanish records of the reconquest contain references to the collections of church equipment found in the hands of the Indians in the Rio Grande towns.[34] Of the Awatovi fragments, one was in rubbish in the main church, one in the vesting sacristy adjoining it and one in the plaza north of the church. One of these fragments is considerably smoothed on the broken edges, due to handling or to abrasion from contact with other objects such as would occur if it were kept in a bundle or bag. It was probably kept by an Indian because of the attractive color and texture of the stone, but might have had symbolic value also.

BOULDERS IN KIVA CACHE

In the cache of stone objects found in Test 14, Room 5, under the bench in the southwest corner of the kiva, were two large stones with rounded surfaces, naturally shaped by weathering. One of these, of fine sandstone, has already been mentioned in the description of the carved animals. It was of the same size and proportions as the large carved mountain lion found in this same cache. The other, of basalt, is less suggestive of an animal shape, although rounded and irregular. One face has been ground flat so that it will stand firmly. It is 23 by 22 by 13 centimeters. Provenience of both Awatovi Pueblo IV (Y-17).

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[33] Montgomery, Smith and Brew, 1949, p. 71.

[34] Hackett, 1942, pp. xcii, cxxxii, cxlv, cxlvii, Pt. II, pp. 257–60.

ANNULAR SUPPORT FOR BAPTISMAL FONT

At Awatovi there were two fragments of a large stone ring found on the floor of the baptistry (Room 465) by the font and nearby in the nave of the main church. It is believed they formed the top of the masonry pedestal on which rested the large bowl used for a baptismal font. In cross-section this ring is 11 centimeters wide and 9 centimeters high, with the outer and inner faces sloping in towards the top. The upper portion consists of three bevelled or sloping surfaces which meet at approximately 150° angles. These surfaces are all ground smooth, and are very precisely shaped, with minute striations remaining from the grinding process. The material is a moderately fine light brown sandstone, such as was commonly used for building. Originally the ring would have been about 60 centimeters in outside diameter.

Like most of the ecclesiastical buildings and their furnishings, this ring was probably produced by Indian workmen under the supervision of the Spanish. It illustrates the excellent workmanship combined with patience and simple technics that characterize Hopi stone working. Although such an object as a large annular support was a totally new idea to the Indian craftsmen, it was produced in a skillful and effective manner by the pecking and grinding technic they had always used.

UNCLASSIFIED FRAGMENTS

Most of these specimens are fragments too small or too incomplete to assign to any category. Beyond the fact that they have been shaped by grinding, rubbing, pecking or polishing there is little that can be said about any of them. Several of the objects of the greatest interest have been described in preceding paragraphs, the painted stone object, the boulders from the kiva cache, etc. The rest, listed here for completeness' sake, do not merit special descriptions.

There are several odd fragments of stone, such as a small polished pebble of banded stone in two colors, bits of stone of odd shapes and materials. Some of these can probably be accounted for by the Pueblo Indians' habitual collecting of curiosities encountered on their travels.

> The Hopi are assiduous collectors. A catalogue of the substances brought to their pueblos from long distances would awaken surprise. . . . Every house is a museum of the environment . . . and every Hopi is a repository of knowledge of the places where materials may be secured. Time and distance are little thought of when it comes to procuring the materials desired.[35]

Besides curios picked up and brought home, which would include some of the fossils, concretions and petrified wood discussed below, some of these fragments of stone are probably from familiar kinds of tools and ornaments, but are too small to be recognized.

Provenience.	Site 264, BM III-early P I	4
	Site 4A, BM III-early P I	2
	Sites 4, 4A, Unassigned	4
	Site 111, P II	5
	Site 169, P II	1
	Site 107, P I-III	6
	Site 104, P II-III	2
	Site 231, P III	4
	Pink Arrow, P III-IV	13
	Awatovi, P III (B/O)	3
	" P IV (O-Y)	1
	" P IV (B/Y)	18
	" P IV (Y-17)	30
	" P V (17c)	86
	" Unassigned	12
	Kawaika-a, P III-IV	2
	Chakpahu, III-IV	1
	Total	194

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[35] Hough, 1902, p. 465.

NATURAL OBJECTS, NOT ARTIFICIALLY MODIFIED[1]

CONCRETIONS

DESCRIPTION

SMALL, very hard masses occur naturally as ferruginous or limonitic concretions in sandstone, as a result of the action of ground water.[2] These concretions weather out of the sandstone and may be picked up in arroyos and on the surface of the mesa. Several kinds of artifact that were occasionally made from them have already been discussed: pecking stones, balls and cupped stones. Only those concretions which have not been modified for such special uses are considered here. The principal shapes in which they occur are bowls, spheres and irregular forms.

Bowl-Shaped. (fig. 40, *d′–g′*) These are approximately spherical concretions, hollow and broken open. Some are weathered very smooth, others are rough. These miniature "bowls" were probably picked up as curiosities, just as one is tempted to collect a pocket full today while walking along an arroyo. It is possible that some might have been used as containers for pigment, but none are stained and none were found with other artifacts that might suggest such a use, and most of them are too small. Diameters range from 2 to 15 centimeters, and most are from 3 to 7 centimeters.

Spherical. (fig. 40, *h′–j′*) These are little balls, either solid or hollow, of 1 to 5 centimeters in diameter. The cache in the southwest corner of the Awatovi kiva, Test 14, Room 5 (Pueblo IV, Y-17) contained nine, along with the artificially shaped stone balls and the carved mountain lion already described. A Pueblo V burial at Awatovi (Room 772, Burial 104) contained a single spherical concretion with the skeleton.

Irregular. (fig. 40, *v–c′*) Odd shapes occur, such as "dumb-bells" and spheres with ear-like or nipple-like protuberances. Some suggest animal or vegetable shapes and may have been valued and kept for that reason. The cache in Test 14, Room 5 at Awatovi (Pueblo IV, Y-17) contained four, of which two were shaped like dumb-bells, one an irregular globule with numerous rounded projections (suggestive of excrement), and one pear-shaped with two knobs that suggest bulging ears or eyes. A burial (No. 75) in the nave of Church 2 at Awatovi had one dumb-bell shaped concretion with it. The sizes of all these irregular shapes are about the same as the spherical concretions, mostly under 4 centimeters in diameter.

Provenience.		Bowl-shaped	Spherical	Irregular	Total
Site 264,	BM III-early P I	—	—	1	1
Site 107,	P I-III	1	—	—	1
Site 111,	P-II	1	—	—	1
Pink Arrow,	P III-IV	3	—	1	4
Awatovi,	P III (W-O)	1	—	—	1
"	P IV (O-Y)	2	1	—	3
"	P IV (B/Y)	7	4	1	12
"	P IV (Y-17)	3	15	8	26
"	P V (17c)	14	15	20	49
"	Unassigned	—	—	2	2
Total		32	35	33	100

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[1] Pigments are not included, as they are reported on by Watson Smith in "Kiva Mural Decorations at Awatovi and Kawaika-a," *Peabody Museum, Harvard University, Papers*, vol. 37. *See* pp. 22–31.

[2] The processes by which concretions are formed are explained in Alberding, 1932.

DISCUSSION

It is impossible to be sure to what extent the concretions found in Jeddito sites were regarded in the same light by their owners as they are by the modern Pueblo Indians. Because of their odd shapes they are believed to be endowed with magical significance and are included in the paraphernalia of shrines and altars. A large concretion is said to occupy a niche in the "Antelope Rock" which stands in the main plaza of Walpi (Hopi First Mesa). Stephen was told that it is "Hehe'ya kachina, that the early Hopi found it here in this rock when they came here. It is of the ancients."[3] This large concretion was, and probably still is, the object of prayers and of meal and prayerstick offerings.[4] The Zuñi also regard peculiarly shaped concretions as valuable, especially in aiding mothers to bear male children and to aid young men in courting.[5]

Although concretions were found in the Jeddito district from Basket Maker III to the 17th century, the only ones found in circumstances suggestive of any special significance were in the Pueblo IV kiva cache at Awatovi, and with two Pueblo V burials. At the Village of the Great Kivas a "curiously shaped concretion" lay on the bench in one of the kivas.[6] At Whitewater there were numerous caches of pebbles, concretions and fossils.[7] Sikyatki graves contained concretions, fossils and fragments of stalactites,[8] and similar objects were found at Homolovi, Chevlon and Chaves Pass.[9] Morris calls all these objects "altar stones" and describes a cache of them found at La Plata Site 41, sealed into a niche in a kiva.[10] The "medicine outfits" found in graves at Pecos are similar, with concretions, fossils, crystals, colored pebbles, worn chipped points, shells, etc.[11] One of the earliest deposits of such objects comes from a Rosa Phase house, dated in the 8th or 9th centuries, where, in a depression in the floor, were found crystalline nodules, a ground piece of stalactite and pieces of calcite, feldspar and quartz.[12] All of these occurrences indicate a long duration of the present pueblo custom of attaching some sort of supernatural importance to the real or fancied resemblances between curious natural mineral formations and the plants, animals and other familiar phenomena of daily life.

FOSSILS[13]

Figure 37, *k–o*.

DESCRIPTION

A few fossils were found in rubbish, all of them unworked except for some smoothing as though from handling. Although their exact sources have not been determined, they probably all come from within the area the Hopi and their predecessors visited frequently, from Zuñi to the Grand Canyon.

Vertebrate.	
Mountain goat (Oreamnos), fragment of horn	1
Elephant, fragment of tooth	1
Unidentified long bones (camel ?)	3
Shark teeth	3
Invertebrate.	
Gastropod	2
Imprint, possibly Cretaceous pelecypod	2
Cephalopod	3
Late Paleozoic brachiopod	1
Late Paleozoic crinoid stem, fragment[14]	1

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[3] Parsons, 1936b, p. 598, fig. 333.

[4] Fewkes, 1898a, p. 730.

[5] Roberts, 1932, p. 145.

[6] Roberts, 1932, p. 61.

[7] Roberts, 1940, p. 127.

[8] Fewkes, 1898a, p. 729.

[9] Fewkes, 1904, p. 107.

[10] Morris, 1939, pp. 130, 138–39.

[11] Kidder, 1932, pp. 104–10.

[12] Hall, 1944, p. 52.

[13] I am indebted to Mr. Robert White of the Department of Paleontology and to Dr. Preston E. Cloud, Jr. of the Museum of Comparative Zoology, Harvard University for examining the vertebrate and invertebrate material, respectively. Its fragmentary condition makes complete identifications impossible.

[14] Another piece of crinoid stem, used as a bead, has already been described (see fig. 31, *j*).

Provenience.	Site 264, BM III-early P I		1
	Site 108, P II-III		1
	Awatovi,	P III (B/W)	1
	"	P IV (B/Y)	2
	"	P IV (Y-17)	4
	"	P V (17c)	5
	"	Unassigned	3
	Total		17

DISCUSSION

Fossils were found in small numbers at only three Jeddito sites, but covering the entire span of occupation known in the area. In considering whether the terms amulet or fetish might be applied to them, it is interesting to consider the distinction between these terms that has been made by Dr. Ruth Benedict. She states: "Material objects when they are treated as supernatural are either amulets if they are the seat of supernatural power in its guise as an attribute of things, or fetiches in its animistic guise."[15] It seems to me highly improbable that the Hopi today, or their prehistoric forebears, regarded fossils and other curious natural objects exclusively from either point of view, or held any precise notions as to the reasons for the importance of these objects. In one of his last important papers Fewkes, who had often tended toward oversimplifying Pueblo religion and symbolism, came to the conclusion that, "It is very difficult to accurately define the line of demarcation in the Hopi mind between what would ordinarily be called an idol and other sacred or cult objects used in worship."[16]

A number of specific beliefs have been recorded which perhaps serve best to indicate the various attitudes of the Hopi and other Pueblos towards objects such as fossils. In his Glossary, Stephen listed *kaai'choki* as a "creature which causes certain kinds of disease . . . disease-causing and -curing fetiches," and Whorf added, on the basis of his work at Mishongnovi, "spiral fossilized object found in rocks, perhaps ammonite fossil, thought to cause ringworm and other spotted skin diseases."[17] This fetish is said to belong to the Lalakon (women's curing) Society, and was represented in a fetish bundle of the society by a fossil cephalopod.[18] There is also a creature, "woman twister" or "heart twister" associated with the Mamzrau Society. She is the cause of painful diseases—"when she attacks a person she penetrates like a screw and tries to rend the heart from its place."[19] The significance of this is that spirally grooved wooden objects which represent Heart Twister on the Mamzrau Altar[20] are similar to the large spiral that Fewkes reports was found near Awatovi and exhibited in the Berlin Ethnological Museum. "This idol is like a stone screw, about 1½ feet high. Around it is a spiral groove; white, red and green bands run around it like the stripes of the same colors on a barber's pole. This idol was probably used for the same purpose as the so called 'heart-twister' on a modern Hopi altar, which legends declare a priestess saved in the massacre and introduced to Walpi from Awatobi."[21] This attempt to trace the Mamzrau (or Marau) ceremony to Awatovi is, unfortunately, not supported by the finding of any large spiral fossils in kivas or shrines excavated by the Peabody Museum Awatovi Expedition. Another women's society, the Oaqöl, is also regarded as coming from Awatovi,[22] but archæological confirmation for it is similarly lacking. In view of the considerable importance given by the modern Hopi to spiral fossils, and probably to fossils in general, it is rather surprising that so few were found at Awatovi. None were found except in refuse. Perhaps the current attitude toward them is a recent development, and did not exist as strongly in the 17th century or before. It may also be that fetishes consisting of fossils were removed from Awatovi to the other Hopi towns in the general exodus following the "destruction" in 1700 or 1701.

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[15] Benedict, 1938, p. 645.

[16] Fewkes, 1924, p. 397.

[17] Parsons, 1936b, p. 1225.

[18] Parsons, 1939, p. 830. Fewkes, 1924, p. 730.

[19] Fewkes and Stephen, 1892, p. 243.

[20] Parsons, 1936b, p. 869, pl. XXIII, XXV.

[21] Fewkes, 1924, p. 383, pl. 3, fig. 1.

[22] Titiev, 1944, p. 169.

SELENITE

DESCRIPTION

Fragments of selenite, a crystalline variety of gypsum which breaks into thin translucent white sheets. The edges are often formed by cleavage planes which meet at a 66° angle, resulting naturally in lozenges and parallelograms. Selenite was occasionally used for pendants, but is too soft to take a polish. Although selenite fragments came from a number of sites and from many parts of Awatovi, nearly half of it (43 pieces) was found in Church 2 at Awatovi.

Provenience.	Site 264, BM III-early P I	1
	Site 106, P III	1
	Awatovi, P III (B/W)	1
	" P III (W-O)	1
	" P III (B/O)	1
	" P IV (O-Y)	1
	" P IV (B/Y)	11
	" P IV (Y-17)	4
	" P V (17c)	72
	" Unassigned	1
	Total	94

DISCUSSION

The occurrence of an occasional fragment of selenite in sites from Basket Maker III and later may be accounted for as were the concretions and fossils just discussed. Any such curiosity might be brought back by a traveller, even if no use were later made of it. No evidence came to light suggesting the use of selenite in windows except in Church 2, where fragments may be from the decoration of steps, since they were too few to make windows a certainty.[23] In New Mexico it was used for windows in early colonial buildings. Unusually large plates can be obtained from outcroppings near Laguna and Socorro.[24] Sources in northeastern Arizona are not at present identified, although selenite probably occurs in the Hopi Buttes just south of the Jeddito district.[25] The largest fragment at Awatovi was only 12 centimeters across, but larger pieces would have originally been present if used in the church windows. Mindeleff, in his splendid study of modern pueblo architecture, refers to selenite in use in windows at Zuñi and Oraibi.[26] There was no evidence of selenite windows at Pecos,[27] but they were used until recently in the church at Ácoma.[28] The single plate of selenite found in the floor of a room at the Whitewater Ruin is regarded by Roberts as insufficient evidence for the practice of glazing windows in Pueblo III times.[29]

CRYSTALS

Figure 32, *f*, *g*, *i*, *j*.

DESCRIPTION

These crystals or fragments of crystals are of natural origin, not shaped in any way except for the slight smoothing of projecting edges of several.

Materials.	Colorless quartz	14
	Smoky quartz	1
	Unidentified pink fragment	1
	Unidentified mass of tiny columnar crystals	1
Provenience.	Awatovi, P IV (B/Y)	1
	Awatovi, P IV (Y-17)	2
	" P V (17c)	10
	" Unassigned	3
	Kawaika-a, P III-IV	1
	Total	17

DISCUSSION

There is no evidence from the few crystals found at Awatovi that they were used as are crystals in modern Hopi ceremonies. But unlike concretions and fossils, there are crystals from only the Pueblo IV and V occupation of the Jeddito district. Ethnographic accounts of the Hopi include a variety of ritual uses for crystals. The following sample suggests the importance of crystals in ceremonial activities:

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[23] Conjectural restorations appear in Montgomery, Smith and Brew, 1949, p. 61.

[24] Northrop, 1942, pp. 18, 167.

[25] Hack, 1942c.

[26] Mindeleff, 1891, p. 196.

[27] Kidder, 1932, p. 111.

[28] Espinosa, 1939, p. 41.

[29] Roberts, 1939, p. 173.

1) Oraibi Powamu ceremony: "A small quartz crystal, to which an eagle feather . . . is attached, is placed in the center of the sun symbol. . . . All put the crystal between their lips and suck on it, saying that it makes their hearts strong."[30] Similarly, in the Oraibi Soyal ceremony, "they sucked four times and held it to their hearts."[31]

2) A "love sorcerer's medicine bundle" contains turquoise, shell, crystal, etc.[32]

3) On the Oraibi Soyal altar there was "a crystal *tiponi* (a quartz crystal inserted into a cylindrical shaped vessel of cottonwood root)."[33]

4) In divining illness: Stephen wrote a vivid account of his "cure" by Yellow Bear, who used a quartz crystal to locate the spot from which to suck a "sorcerer's arrow."[34]

5) Used in "medicine bowl" with water and sacred corn meal, in the Walpi Niman Kachina ceremony.[35]

6) To reflect sunlight into a bowl of "medicine," which is interpreted by Titiev as a "prayer for fertility."[36]

Elsewhere, crystals have been found under conditions strongly suggesting that they were employed for ritual or symbolism. Significant finds include: Piedras sites where they were in mortuary bowls,[37] Bear Ruin with a burial,[38] beneath the floor of house at McDonalds Canyon Ruin, near Holbrook,[39] at Starkweather Ruin in the bottom of postholes,[40] and with burials at King's Ruin.[41]

PETRIFIED WOOD

FIGURE 37, *a–i.*

DESCRIPTION

Most of the unworked fragments of petried wood are elongated tabular pieces 3 to 10 centimeters long, broken off almost square at the ends and with edges approximately parallel. Most of them show a slight degree of smoothing on the projecting corners which is probably not the result of weathering. The material is a dull, non-agatized variety of petrified wood, of a light buff color with almost no streaking or grain. When the pieces are rattled against each other they give a high-pitched tinkle that may account for their having been collected by the Indians. None were found in groups, however, or with any other indication that they had been used together in any way.

A few fragments of a more completely metamorphosed material were found (fig. 37, *h, i*). They are an agatized wood of brown, yellow and red, with conchoidal fracture instead of the columnar fracture of the dull buff pieces. This agatized material has been highly polished but without any attempt to modify the shapes it had broken into naturally.

The petrified wood occasionally used for pecking stones (fig. 19, *r*) does not resemble any of these fragments. It is intermediate in appearance, since it has a columnar structure, dark brown and banded. It has the same appearance as the two hammerstones from the Whitewater District illustrated in Roberts' report.[42] Petrified wood was used for pecking stones at Sites 4A, 104, 111 and 263.

Source of the Jeddito petrified wood is uncertain, but Dr. Kirk Bryan suggested that the dull buff material may come from the Chinlee or Shinarump formations, close to Awatovi. Agatized petrified wood is not known to come from any source closer than the Adamana area.

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[30] Voth, 1901, pp. 76, 81.

[31] Dorsey and Voth, 1901, p. 45.

[32] E. and P. Beaglehole, 1935, p. 8.

[33] Dorsey and Voth, 1901, pl. I.

[34] Parsons, 1936b, p. 857 *et seq.*

[35] Parsons, 1936b, p. 512.

[36] Titiev, 1944, p. 105.

[37] Roberts, 1930, p. 154.

[38] Haury, 1940, p. 104.

[39] Hough, 1903, p. 303.

[40] Nesbitt, 1938, p. 39.

[41] Spicer, 1936, p. 58.

[42] Roberts, 1940, pl. 42, *c, d.*

Provenience.	Site 264, BM III-early P I	2
	Site 107, P I-III	1
	Pink 103, P II	3
	Pink Arrow, P III-IV	3
	Awatovi, P III (B/O)	1
	" P IV (O-Y)	1
	" P IV (Y-17)	39
	" P V (17c)	43
	" Unassigned	3
	Total	96

Figure 37, *e*, was found with Burial 85 in front of the Awatovi Church 2. It is a tabular fragment 4.4 centimeters long, with the corners smoothed.

DISCUSSION

An observation made by Voth during the Oraibi Snake Dance suggests the possibility that some of these slivers of petrified wood were used as tinklers, for which they would be admirably suited. He reports that such slivers were tied as rattles on the belt of a warrior in the ceremony.[43] This is the same belt referred to in Stephen's Glossary as *wuko'kive' wa,* big belt, and he adds, "this belt with its fringe typifies falling rain."[44] Other belts are described with antelope hoofs, shells, small sleigh bells and even pieces cut from old tin cans.[45] The use of petrified wood tinklers has survived to the present in New Mexico. At Santa Ana they were fastened to a stick to be carried in the hand, and also hung on a bandoleer worn over the shoulder.[46] If any of the Awatovi petrified wood had been thus used, the pieces had been scattered and discarded, as none were found together in a group.

It is said to be common for the Hopi to place pieces of petrified wood in shrines, like the one at Old Walpi which contains a large piece of a log.[47] The practice also exists among other Pueblos.[48] However, none of the pieces at Awatovi seemed to have been objects of any special significance except perhaps the one found with a 17th century burial.

STALACTITE

Figure 37, *j*, is a fragment of crystalline material, with a trefoil cross-section, probably a stalactite. Length 6 centimeters, thickness 2 centimeters. Awatovi, Pueblo V (17c).

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[43] Voth, 1903b, p. 337, note 3, pl. 203.

[44] Parsons, 1936b, p. 1240.

[45] Parsons, 1936b, 752, 127, 401, 1208.

[46] Collections of the Laboratory of Anthropology, Santa Fé.

[47] Fewkes, 1898a, p. 586.

[48] Parsons, 1939, pp. 308, 986.

Part III

SUMMARY AND CONCLUSIONS

SUMMARY AND CONCLUSIONS

TEMPORAL AND AREAL DISTINCTIONS

IN the creation of those chronological and geographical frameworks which are a necessary preliminary in archæological research, stone artifacts can often play only a rather limited role. A glance at table 19 will show that there are hardly any traits in the inventory of stone from sites of the Jeddito district which, when found in a site, would immediately serve to identify associated materials in the time scale. A few sherds of Jeddito Black-on-Orange, or of St. Johns Polychrome, on the other hand, would offer a good indication of the period of occupation of the site. Similarly, most of the forms of stone artifacts from the Jeddito district are not truly distinctive of the locality, but instead, are common to large parts of the Pueblo area, and sometimes of the entire Southwest.

However, the results are not completely negative, and a number of highly distinctive and significant traits have been pointed out. They are worth mentioning again here, although the discussions of each group of artifacts have already included this information.

TABLE 19: Persistence of Jeddito Stone Traits*
(x present. – present but rare. ? probably present)

	BM III–Early P I	P I	P II	P III	P IV	P V
Pecking stone	x	x	x	x	x	x
Pounding and rubbing stone	x	x	x	x	x	x
Polishing pebble	x	x	x	x	x	x
Grinding slab	x	x	x	x	x	x
Side notched point, wide base, stem narrower than shoulder	x	x	x	x	x	x
Mano, single grinding surface	x	x	x	x	x	x
Mano, 2 opposite grinding surfaces	x	x	x	x	x	x
Mano, 2 adjoining grinding surfaces	–	x	x	x	x	x
Mano, one-hand	x	x	x	x	x	x
Flake tool, no retouch	x	x	x	x	x	x
Flake tool, retouch on 1 face	–	x	x	x	x	x
Simple grooved abrader	x	x	–	x	x	–
Petrified wood	x	?	x	–	x	x
Discoidal hammerstone	x	–	–	x	x	x
Pebble pounder	x	?	–	x	x	x
Diagonal notched point, broad shouldered or barbed	x	–	–	–	x	x
"Chopper"	x	?	x	x	x	–
Unperforated ornament	x	?	–	–	x	x
Oval full-grooved hammer	x	x	?	–	–	–
Full-grooved axe	–	?	x	x	x	x
Pendant	–	–	–	–	x	x

*for number of specimens representing each trait see table 3.

Table 19: Persistence of Jeddito Stone Traits (cont.)
(x present. – present but rare. ? probably present)

	BM III–Early P I	P I	P II	P III	P IV	P V
Elongated pitted hammerstone	–	–	–	–	–	x
Irregular full-grooved hammer	–	x	–	–	–	–
Weight (?)	–	..	..	..	x	x
Mortar, roughly shaped	x	..	..	–	x	x
Mortar, bowl shaped	x	..	..	–	x	x
Drill	–	..	..	–	x	x
Ball	x	..	..	..	x	x
Pipe	–	..	..	–	x	–
Lipped full-grooved hammer	x	x	x	x	–	..
Mano, convex surface	x	x	x	..	..	..
Troughed metate, one end open	x	x	x	..	..	..
Troughed metate, platform at closed end	x	..	..	..	..	..
Troughed metate, 2 ends open	–	..	x	..	..	..
Diagonal notched point, slender barbed	x	?	?	..	..	..
Mano, 3 grinding surfaces	..	x	x	x	x	x
Symmetric stemless blades, straight base	..	–	–	..	–	–
Grooved or notched mano	..	..	x	x	x	x
Small tapered stone	..	..	x	..	–	x
Core	..	..	x	–	x	x
Spherical full-grooved hammer	..	..	x	x	..	..
Ring	..	..	–	..	–	..
Tabular flat abrader	..	..	–	x	x	x
Tabular bar-shaped abrader	..	..	–	–	x	–
Thick cylindrical stone	..	..	..	x	–	–
Notched axe	..	..	..	x	x	–
Notched hammer	..	..	..	x	x	–
Bead	..	..	–	x	x	–
Incised decoration	..	..	..	x	x	–
Shaftsmoother, transversely grooved	..	..	..	x	x	–
Small, rough cylindrical stone	..	..	..	x	x	–
Slender polished cylindrical stone	..	..	..	x	x	–
Tcamahia	..	..	..	x	x	x
Shaftsmoother, elongated	..	..	..	x	x	x
Flat metate	..	..	..	x	x	x
Cylindrical hammerstone	..	..	..	x	x	x
Mano, 4 grinding surfaces	..	..	..	–	x	x
Shaftsmoother, ridged	..	..	..	–	x	x
Cooking slab	..	..	..	–	x	x
Asymmetric stemless blade	..	..	..	–	x	x

TABLE 19: Persistence of Jeddito Stone Traits (cont.)
(x present. – present but rare. ? probably present)

	BM III–Early P I	P I	P II	P III	P IV	P V
Flake tool, retouch on both faces	..	..	..	–	x	x
Symmetric large stemless blade, straight base	..	..	..	–	–	x
Side-notched point, straight base, stem wider than shoulder	..	..	..	–	..	x
Irregular flat abrader	..	..	..	–	x	–
Jar lid (?)	..	..	..	–	–	–
Minature troughed metate	..	..	..	–	..	–
Hoe (?)	..	..	..	..	x	..
Three-quarter grooved axe	..	..	..	..	x	x
Three-quarter grooved hammer	..	..	..	..	x	x
Pestle	..	..	..	..	x	x
Paint grinding stone	..	..	..	..	x	x
Shaftsmoother, loafshaped	..	..	..	..	x	x
Cupped stone	..	..	..	..	x	x
Carved animal	..	..	..	..	x	x
Symmetric stemless blade, round base	..	..	..	..	x	x
Side-notched point, notched base, stem wider than shoulder	..	..	..	..	x	x
Diagonal-notched point, tapered stem	..	..	..	..	x	x
End scraper	..	..	..	..	x	x
Crystal	..	..	..	..	x	x
Three-quarter grooved axe, double-bitted	..	..	..	..	–	..
Full-grooved axe, oblique groove	..	..	..	..	–	x
Full-grooved axe, partial-spiral groove	..	..	..	..	–	x
Raised-border palette	..	..	..	..	–	x
Loomblock	..	..	..	..	–	x
Serrate point	..	..	..	..	?	x
Pick (?)	..	..	..	..	–	–
Mica object	..	..	..	..	..	x
Three-quarter grooved axe, lipped	..	..	..	..	..	–
Small conical stone	..	..	..	..	..	–
Side-notched point, concave base, stem wider than shoulder	..	..	..	..	..	–
Side-notched point, narrow base, stem narrower than shoulder	..	..	..	..	..	–
Totals	35	29	38	56	78	81

Axes and Hammers. The full-grooved axe and the oval full-grooved hammer occur in all six periods of the Pecos System with which we are here concerned. But three-quarter-grooved implements appear only in Pueblo IV and V, at the same time that a few highly specialized forms of axe occur: lipped, double-bitted, oblique-grooved, and partial-spiral grooved. Only the spherical and the lipped full-grooved hammers disappear before the 17th century, thereby serving as useful diagnostic criteria for the earlier periods. Notched axes and hammers are limited to Pueblo III, IV and V.

Metates and Manos. A clear-cut distinction is present between Basket Maker III, Pueblo I and II, when only troughed metates were used, with their accompanying convex-surfaced manos, and Pueblo III, IV and V, when only flat metates were used. For some reason that is not understood, manos of the shape used on flat metates occur at the earlier sites, apparently prior to the invention of the flat metate. The troughed metate with shelf at the closed end is one of the *two* stone traits found in only the Basket Maker III and early Pueblo I horizons.

Pounding, Pecking and Rubbing Tools. Most of the unspecialized tools for these processes occur throughout the entire occupation of the Jeddito area, except for cylindrical hammerstones, which first appear in Pueblo III. Paint grinding stones and pestles (as the terms are used here) come only from Pueblo IV and V.

Flat Abraders. None occur until Pueblo II and they are rare until Pueblo IV, except for the tabular shape, which occurs frequently also in Pueblo III. This shape is the only one characteristic of Pueblo V, although others (bar-shaped and irregular) are present in small numbers. These are among the few forms of tool that disappear or become rarer in Pueblo V, which, generally speaking, includes most of the stone traits of Pueblo III and IV.

Grooved Abraders and Shaftsmoothers. Simple grooved abraders occur in all six periods, although becoming rare in Pueblo V. Shaftsmoothers are characteristic of Pueblo III and later periods, but the transversely grooved form is less common in Pueblo V than before.

Raised-Border Palettes and Loomblocks. These appear at the close of Pueblo IV and are common only in Pueblo V.

Grinding Slabs and Mortars. The relative scarcity of stone material from Jeddito sites of Pueblo I and II may account for the absence of mortars, since they were in use there during Basket Maker III, and occur also in Pueblo III and later. Grinding slabs are one of the implements common to all periods.

Chipped Stone. Slender barbed diagonal-notched points are characteristic of only Basket Maker III-early Pueblo I times. The only other shapes of chipped point found with them persist to Pueblo V. Chipped drills are missing in Pueblo I and II, but occur earlier and again in Pueblo III and later. So little chipped stone was found, however, that the first appearance of most shapes in Pueblo III and IV may be due to an accident of sampling.

Other Artifacts. A few traits such as pipes, "weights," and balls are missing in Pueblo I and II, although present earlier and again in Pueblo III and later. This absence may not be significant, except to suggest the scarcity of stone material from those two periods. A number of other traits, mostly represented by relatively few artifacts, occur in the later periods only, and hence have some diagnostic value. Their absence at a site can not alone be considered conclusive evidence of an early date, however. These traits, and their duration, are indicated in table 19.

A few forms seem to be characteristic of only the Jeddito district, being either unreported elsewhere, or very rare. Paint grinding stones of the kind described here are common only in the Hopi area. Likewise, the very distinctive shouldered pestles found at Awatovi are unique, not like any of the elongated stones for pounding or crushing found elsewhere in the Southwest and called pestles in various publications. Of the several forms of shaftsmoothers, those described here as "loaf-shaped" are peculiar to Awatovi, as far as is known. Raised-border palettes may have been originally, and indirectly, inspired by the Hohokam palettes, but they are larger and cruder, and occur at a much later date than do the earliest Hohokam palettes. Except at Awatovi and among the modern Hopi, almost none have been reported in the Pueblo area. The loomblocks found at Awatovi and Kawaika-a, of late Pueblo IV and Pueblo V date, are like those used by the Hopi in recent years. Prehistorically, such loomblocks are known elsewhere only along the Little Colorado and eastward on the Mogollon Rim. Grooved "weights" and cupped stones, both of unknown use, are apparently characteristic of no locality except the Jeddito district.

The position of the Jeddito sites in the general cultural history of the Southwest would be difficult to determine from the stone artifacts alone. Even to attempt it would, of course, be unnecessary, because of the wealth of other information on which to draw when the complete story of the Jeddito area is written. It has proved impossible, in fact, to evaluate the significance of the stone material without some consideration of the larger picture, using pottery as an aid to determining chronology, referring to architectural data in order to judge how and when metates began to be put in bins, using what we know of agriculture, early contacts with the Spanish, and modern ritual practices to determine the possible significance of tcamahias and hoes, and so on.

Nevertheless, confronted with only the stone artifacts, and lacking all the other data, it would be obvious that the sites belonged within the Pueblo cultures. But the location, between the Little Colorado and the Kayenta, might be harder to guess. Such traits as the troughed and flat metates would aid greatly in determining the time span of the occupation, although not with the precision possible by means of pottery types and tree rings. At present, information on the characteristic stone artifacts of each period for the main subdivisions of the Pueblo area is still very scanty. As an experiment, I attempted to compile trait lists for successive periods in the Pecos System, for the Mesa Verde, the La Plata district, Chaco Canyon, the Rio Grande, the Little Colorado and the Kayenta areas. None of these lists could be made complete enough to permit any satisfactory comparison of trait frequencies with the Jeddito area. So many traits were absent, presumably only due to lack of digging or publication, that those known to be present appear hopelessly inadequate for any conclusions as to degree of likeness or number of shared traits between areas. Before statistical methods for the determination of prehistoric cultural relationships can be used, a long and patient accumulation of precise archæological data is needed throughout the Southwest.

Lacking the basis for an overall evaluation of relationships between the Jeddito and other Pueblo areas, there are, nevertheless, some interesting inferences to be drawn from the stone artifacts, of the directions from which trade, cultural stimulation, or migrations may have come. These will be briefly reviewed here, although the evidence for them will not be repeated, as it has already been given in detail in the discussions of the various artifacts.

The finding at Site 264 of two metates with a distinctive shelf-like arrangement at the near end immediately suggests central and northern Utah, where this is a common form, and also the early Mogollon Culture sites of Bear Ruin and Bluff, in central Arizona, where the same form occurs. No other evidence exists to relate Site 264 with Utah, but a connection with the Mogollon Culture is possible. Work on the pottery and architecture has shown that there are important similarities between Bear Ruin and Site 264, which are contemporary. The Bluff Site is considerably earlier than Bear Ruin, and about a mile away from it.

A much less certain connection between Site 264 and the Mogollon Culture is suggested by the tapered tubular pipe found at Site 264. A cruder form is characteristic of the SU Site of western New Mexico.

During Pueblo I and II there were not many innovations in Jeddito stone working, and for none of them can a source be suggested. Whether this indicates isolation of the area at this time can be judged better after further study of the pottery.

The notched axes and hammers that appear in Pueblo III are so much like those of the San Juan, where they are characteristic from Basket Maker III onward, that a northern origin for the traits seems probable. It is surprising that they did not appear sooner in the Jeddito area, since elsewhere they generally were used concurrently with the earliest full-grooved axes. The jar lids from Pueblo III Awatovi are another link with the San Juan, where they were a frequent trait even earlier than this.

Tcamahias and carved animals both appear in Pueblo IV, the former almost certainly from the Mesa Verde and La Plata districts of the San Juan. Carved animals somewhat like those at Awatovi have also been found in Mesa Verde and Kayenta sites, although rarely. More important than the possible connections with the north shown by both these traits is the link they provide with modern Keresan pueblos in New Mexico. Hopi-Keres relationships are a problem needing more work, and one that will benefit when we have data on prehistoric Keresan sites comparable to the data from Awatovi on the prehistoric Hopi.

In Pueblo III at least one trait may have been introduced from the east, the elongated shaft-smoother, which has its closest parallels at Pecos and eastward on the Plains. The end scrapers that appear at Awatovi during Pueblo IV may have had a similar eastern origin.

The Rio Grande pueblos are a source, by means of trade or of actual migration, of the specialized axes with oblique and partial-spiral grooves, and of the axes of sillimanite schist. Most of these occur in Pueblo V, but a few reached Awatovi in late Pueblo IV times. The Pueblo region had dwindled in size at this time from its previous great extent, and was splitting into eastern and western sections, with the Zuñi Pueblos furnishing a link. However, a vigorous cultural development was in progress in both areas, so it is somewhat surprising not to find more evidence in the stone artifacts of contacts between the two. Data on more of the Pueblo IV and V Rio Grande pueblos will soon be available, and may furnish indications of closer relations between east and west than now appears to have existed.

The Hopi region may have been even more strongly influenced during Pueblo IV by its neighbors to the south. The reappearance of mortars, absent in Pueblo I and II and rare in Pueblo III, is suggestive, as mortars were always more characteristic of Hohokam than of Pueblo culture. The three-quarter-grooved axe and hammer had spread north via the Verde Valley and the headwaters of the Little Colorado during Pueblo II and III, and appear in the Jeddito as an indirect Hohokam contribution. Trade with the south had probably existed previously, however, as shown by the minute stone beads found in a Pueblo III burial. There is a possibility also that the distinctive Awatovi pestles and the raised-border palettes have a Hohokam derivation, although direct parallels are lacking; but if these ideas did come from the south, local modifications took place in the Hopi region. Serrate points and zoömorphic pendants both are common Hohokam traits of long duration, which occur also, though rarely, in the Jeddito district in Pueblo V. The single spindle whorl found at Kokopnyama is likewise almost certainly of southern origin, since no other examples are known from the Pueblo area.

Loomblocks, now peculiar to the Hopi, were apparently invented along the Little Colorado in Pueblo IV times, and thence the idea spread north to Awatovi and Kawaika-a. The trait has persisted to the present day.

All of the above suggestions need to be checked in terms of other evidence collected by the Peabody Museum Awatovi Expedition before they can be considered fully acceptable. It will be interesting to see if the ceramic evidence, in particular, supports these hints as to the connections of the Jeddito sites with the San Juan, with the Rio Grande and with the Hohokam Culture. The greater distinctiveness of local pottery styles makes them a much easier basis for discovering such connections than the relatively unspecialized forms of stone implements.

TECHNICS OF STONE ARTIFACT MANUFACTURE

From the beginning of this study there was a desire to consider not only the ultimate form and appearance of the artifacts studied, but also the *processes* by which they were produced. In a general way, archæologists have long been familiar with the various technics of manufacture used in making stone tools, so nothing startlingly new was expected. But the observation of technical details and the inferences from them of processes of production can add to our all-too-meager information about the cultural behavior of a past population. In this study, therefore, and in a literal sense, "no stone was left unturned."

Even a cursory examination of an artifact reveals some technical information. When Fowke wrote "Stone Art"[1] he divided the artifacts to be described on a technological basis already familiar and widely used, namely, "ground and pecked articles," and "chipped stone articles." But there, as in many later publications, the processes are inferred, to be used chiefly as a convenient basis for classification.

Archæological interest in manufacture as a part of the human activity which can be inferred from artifacts has lagged seriously behind interest in classification and description. Archæologists have, in fact, recently been sternly reproved for their lack of cultural interpretation and their preoccupation with description and chronology. In connection with this an ambitious program to re-orient archæological thinking has been proposed.[2] With rare exceptions, ethnographers have not provided an over-abundance of information on the stone-working processes still in use by non-industrial peoples in various parts of the world. Such information is indispensable as a basis for the fullest and most meaningful interpretation of archæological data. In regard to the Jeddito area in particular, the author's brief field investigation of the Hopi in 1947 suggested that less acculturated groups would be somewhat more instructive on the technology of stone working, but that even here there was useful information which was not available from all the protracted and intensive ethnographic, psychological and cross-disciplinary studies of the Hopi. Undoubtedly, there is something to be learned from other Pueblo groups, also, although ideally Hopi data would be preferable as a basis for inferences from the Jeddito archæological sites. Any attempted interpretations must be cautious, particularly until they can rest on a firmer base of observed details of the "primitive" technologies still extant.

We are more fortunate in the experimental work that has been done on stone-working methods. While experiments must leave many problems untouched, they have demonstrated that so-called "lost arts" are not necessarily irrecoverable, and that previous knowledge can be derived of the limitations and potentialities of "primitive" technics. Such knowledge is essential in providing a starting point for interpretations of archæological specimens. A few examples will indicate the kind of factual data on processes, properties of materials, and effectiveness of finished tools that the archæologist can already draw upon. The experiments of Halvor Skavlem[3] are particularly useful. Among other things, he has demonstrated that the production of such tools as grooved hammers and axes by means of pecking and abrasion is not the arduous and endless task frequently assumed. Similarly revealing experiments have been made in chipping, showing that the skillful and experienced fabricator can produce blades and points with great speed and precision. The short movie, "Making Primitive Stone Tools," recently produced by Douglas Leechman of the Canadian National Museum, Ottawa, vividly demonstrates this. Basic to an understanding of stone tools is an appreciation of their physical properties. So far, there is little information directly oriented to the archæologist's interests, since the essential facts to be found in standard mineralogy and petrology handbooks are selected to serve other purposes. Consequently, Goodman's study of hardness and density of various materials[4] is all the more significant and useful. Less ambitious but equally suggestive experiments have been made on specific and limited problems.

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[1] Fowke, 1896.

[2] Taylor, 1948.

[3] Pond, 1930.

[4] Goodman, 1944.

Earl Morris' use of stone axes in felling and trimming trees has already been mentioned under Grooved and Notched Axes. The difficulties of drilling stone by primitive methods have been well studied and reported by B. W. Knoblock[5] in connection with his investigation of bannerstones. Even where these and other investigations did not furnish the particular details needed to understand the artifacts from the Jeddito district, they have proved immensely helpful in the attempt to appreciate stone working in general. It is to be hoped that experiments will continue, and that the unreported experiences of archæologists who have made and used stone tools will appear in print.

STONE-WORKING TECHNICS IN THE JEDDITO DISTRICT

All stone implements are subject to modification in varying degrees, as a result of their use. While such wear is a clue to their function, and sometimes thus assumes great significance, it is necessary to disregard it as far as possible in judging the processes by which the implements were originally made. Although seemingly obvious, this distinction between the initial shaping and subsequent wear has frequently been lost sight of by archæologists, with the result that meaningless statements have been made about details of stone-working technics. With this word of caution in mind, we can now turn to a consideration of the artifacts themselves and of the inferences which can be derived from them.

At Awatovi and the nearby sites, the technics used in the manufacture of stone implements were few in number and simple in application, namely:

Pecking, the crushing or crumbling of material in small amounts by repeated blows, localized at the point of impact of the relatively hard piece of stone used.

Abrading and grinding, removal of material by friction, a process applied to shell, bone, and wood as well as to stone.

Chipping, the application of a blow or pressure so as to remove a fragment of stone. This can be accomplished effectively only on certain kinds of rock, those of very uniform texture and considerable hardness, such as chert and obsidian.

Examples of implements made by each of these technics or by combinations of them, have been pointed out and commented on in the preceding chapters. In some instances there has been a discussion of the data from which the use of these technics was deduced. The remarks which follow, therefore, will be brief and general, and will not repeat previous details.

Pecking. The majority of artifacts from northern Arizona were shaped by pecking, which was sometimes but not always followed by abrading. The importance of the method to the Indians is suggested by the large number of tools used (*inter alia*) as pecking implements; pecking stones (total, 776), pounding and rubbing stones (total, 405) and pebble pounders (total, 154). In addition some of the hammerstones and many of the re-used axes of various forms were undoubtedly used as pecking tools. Such tools were, then, essential in the Indian technology as a means of producing many other tools. There were many other tasks which could be accomplished with these same tools besides the shaping of stone by pecking. Several of these uses are discussed under Tools for Pounding, Pecking, and Rubbing. Unfortunately, it is impossible to determine from examination of an individual tool the particular function it served, and, of course, it is probable that most tools served a variety of uses at one time or another. So, the number of pecking tools cannot be precisely determined, and the figures just given are intended only to suggest their considerable number in relation to the total of all stone artifacts.

When the objects which were produced primarily by means of pecking are considered, the importance of the technic appears even more clearly. Manos of all shapes (total, 2476), flat metates (total, 537), and many other larger types of implements showed evidence of being shaped by pecking. Unused manos demonstrate this particularly well (see Manos). If not obliterated later, pecking leaves the surface of a stone artifact rough, with all major irregularities removed, and showing only the innumerable slight depressions or scars caused by individual blows. On such objects as axes, and shaftsmoothers the surface was generally ground smooth or even polished, but the probability that they were initially roughed out by pecking is supported by occasional traces remaining of the characteristic pitted surface. Although it is a technic that can be used on a great variety of materials, pecking seems particularly effective on rock that is composed of small individual particles cemented together not too firmly, in other words, the locally abundant sandstones.

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[5] Knoblock, 1939, pp. 81–114.

Abrading. Although this technic, which became the hallmark of the Neolithic, seems to have been first used on stone in the Old World, and only after many millennia of use on bone, antler, and wood, it is a simple and effective means of shaping stone objects. The abrasion may be accomplished directly by a stone tool of coarse or gritty texture, or indirectly by sand held together by water and placed between the object being shaped and the tool with which the rubbing is done. On many implements abrasion is incidental to their use, but may not have been involved in their initial shaping. The wear on the grinding surfaces of metates and manos eventually results in such a smooth surface that effective grinding is possible only after the surface is re-roughened by pecking. On other implements the abrasion is not a result of use, and it is hard to believe that it would be essential from a purely utilitarian point of view. Instead, it seems to have been indulged in only for the esthetic pleasure it afforded the makers and users of the artifacts, particularly on such axe materials as sillimanite. Finally, abrasion is essential on a few implements, in order to produce the sharp cutting edge of an axe blade, for example, or to provide the smooth surface on which paints were ground and blended in a palette. For some very small or delicate objects, such as ornaments, it was necessary as a means of avoiding breakage during manufacture, and of achieving the desired precision.

A relatively small proportion of all stone artifacts was shaped or finished by abrasion. It was used to a greater or lesser degree on axes (total, 180), hammers (50), paint grinding stones (64), pestles (25), shaftsmoothers (132), palettes (20), grinding slabs (89), mortars (71), loomblocks (40), carved animals (12), tcamahias (25), cooking slabs (22), and a number of small objects, including ornaments, pipes and others of undetermined function, such as small cylinders. A careful examination reveals faint faceting on some of these objects, a result of shaping a rounded surface by abrasion with a flat object. With a hand lens there are usually to be seen minute parallel striations, also indicative of the manner in which the abrasion was accomplished.

Unequivocal evidence is lacking as to the equipment used for shaping these artifacts by grinding, and for polishing axes, shaftsmoothers, and a few others. Some of the tools here classified as flat abraders would have been as suitable for use on stone as on wood or bone. They were not abundant (total, 97) and it is highly probable that other tools, either not recognized or not found, were also used. In the Jeddito area scraps of abrasive stone would have been easily available and hence likely to be readily discarded, but unless they showed conspicuous signs of use they would have been almost unrecognizable to the archæologist.

Chipping. The effectiveness of chipping and flaking as shaping technics lies in the speed and ease with which sharp cutting edges may be produced in suitable materials. As compared to pecking and abrasion, chipping requires highly developed skill rather than merely patience, and involves many slight variations in method which produce particular results. It can thus aid in the making of special shapes of tools and types of cutting edges. Archæologists have given considerable study to these details of the chipping technic, particularly in connection with the Old World Paleolithic, since some details have both areal and temporal significance.[6]

Artifacts shaped by chipping were found in surprisingly small numbers in the Jeddito excavations, although knives and scrapers so made must have been indispensable in many common tasks. The commonest chipped tool was an unshaped flake (total, 734) with one or more edges sharpened by "retouching," that is, removing very small, closely spaced chips by means of pressure. An edge can be sharpened several times in this way, but eventually would become too thick to be effective. Pressure flaking was also used in shaping many of the points and blades designed to be hafted; after a suitable flake had been produced, probably removed by percussion from a core or nodule, the desired shape was secured by well-controlled percussion or by pressure.

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[6] See Oakley, 1950, pp. 23–31, for an excellent short summary of chipping methods.

It is evident that flint was not brought to Awatovi and the other sites in any great quantity, as far too few scraps were found to indicate an active production of chipped artifacts on the spot. It can be conjectured that many of the tools were imported, or were made at locations considerably removed from the settlements, presumably the quarries where the flint was found.[7] In only one instance were a considerable quantity of chips (total, 47) found together, suggesting that they had been thrown out as debris from a workshop (see p. 137). It would be interesting to identify the sources from which chipped implements or flint for them came to these sites, but it will be necessary first to have geological reconnaissance on a very intensive basis followed by both archæological and ethnographic investigations, none of which has been sufficiently well accomplished to date.

INTERPRETATIONS OF TECHNOLOGY AND ECONOMY

The descriptions and discussions of the artifacts in this report have been arranged with little regard to the functions served by the objects themselves. Some served a variety of uses, and of some we know almost nothing of their purpose. The following list indicates those activities and processes of daily life in prehistoric times, in connection with which the indicated stone tools were probably used. Activities in which stone artifacts played no part have been omitted. The list is based, first, on a careful examination of the objects themselves for evidence as to the ways in which they were used, second on ethnographic data from the Hopi and other modern Pueblo tribes, and third, on conjecture.

Agricultural activity
    Hoes
    Tcamahias (doubtful)
    Notched axes (doubtful)
    Picks (doubtful)
    "Choppers" (doubtful)

Food preparation
  1. Grinding and crushing
    Metates and manos
    Mortars and pestles or hammerstones
    Raised-border palettes (modern Hopi only ?)
    Pounding and rubbing stones (?)
  2. Securing fire wood
    Axes
    Hammers
  3. Cooking
    Cooking slabs
  4. Containing
    Bowl-shaped mortars
    Jar lids

Hunting and butchering
    Spherical full-grooved hammers (as clubs?)
    Stone balls (as clubs ?)
    Chipped blades and points (on arrows, darts or spears)
    Chipped blades and points (as knives)
    Unshaped flake tools (cutting and scraping)
    Pounding and rubbing stones (in dressing hides ?)
    One-hand manos (in dressing hides ?)

Manufacture of stone implements
  1. Pecking and pounding
    Pecking stones, re-used axes, hammers
    Hammerstones (discoidal, cylindrical and elongated-pitted)
    Pounding and rubbing stones
  2. Chipping and flaking
    Pecking stones (probably used much less than tools of bone, antler or wood)
  3. Grinding and sharpening
    Flat abraders
    Pounding and rubbing stones
    Small rough cylindrical stones (?)

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[7] In Bryan, 1950, there are discussed some of the problems concerning quarries, particularly the evidence that they served as "factories" as well as sources of raw material. No flint quarries have been studied in the Jeddito district.

Manufacture of wood and bone implements
1. Scraping and cutting
    - Chipped blades and points
    - Unshaped flake tools
    - End scrapers
2. Sawing
    - (none ?)
3. Piercing
    - Chipped drills
4. Abrading and polishing
    - Flat abraders
    - Shaftsmoothers
    - Simple grooved abraders
    - Small rough cylindrical stones (?)
5. Heating and straightening
    - Shaftsmoothers (especially loaf-shaped ?)

Manufacture of pottery
1. Preparation of materials
    - Metates and manos
    - Grinding slabs, pounding and rubbing stones
2. Finishing surfaces
    - Polishing pebbles

Weaving and spinning
  Loomblocks
  Spindle whorls (usually of pottery ?)
  Grooved abrader for smoothing yarn (?)

Preparation of paint
  Raised-border palettes
  Paint grinding stones
  Grinding slabs
  Pounding and rubbing stones
  Metates and manos (?)

Housebuilding
1. Stone working
    - Re-used axes, hammers, pecking stones, etc.
2. Wood working
    - Axes
3. Plastering
    - Pounding and rubbing stones

Quarrying
  Picks
  Notched hammers

Smoking (tobacco ?)
  Pipes (more commonly made of pottery)

Decorating, symbolizing, representing, gaming
  Pendants
  Ornaments
  Mosaic
  Beads
  Rings
  Tcamahias
  Slender polished cylindrical stones (nose plugs ?)
  Small thick cylinders
  Small conical stones
  Carved animals
  Balls
  Crystals
  Small tapered stones
  Fossils
  Concretions
  Petrified wood
  Cupped stones

Spanish religious or military activities
  Marble slabs
  Annular base for baptismal font
  Selenite (for windows or church decoration)
  Mica objects (decoration on church furnishings)
  Gun flints (?)

A consideration of the stone artifacts from the Basket Maker III-early Pueblo I sites in the Jeddito district shows that they are suited to all the processes listed above which would be necessary to providing shelter and food. There is no way to judge whether agriculture was any less important than later, though this is very probable since game was doubtless more plentiful when the population was smaller. The scarcity of chipped points from this early horizon may mean only that devices such as traps and snares, and the technics of surrounding or running down game were common. The household equipment of metates and manos differed in form from those of the later inhabitants of the same area, but probably produced much the same sort of corn meal. Pecking stones, grinding slabs, etc., were indistinguishable from those in use centuries later. The conspicuous absences in this early period are in the class of symbolic or ritual objects. Petrified wood was present, though rare, and possibly already had the symbolic connotations that it later had. Likewise there were stone balls, for which ceremonial functions have been suggested, but not proved. The only other "luxury" items were pendants, unperforated ornaments and a single tobacco (?) pipe. Abundant ritual objects of perishable materials may have existed, of course, but the contrast with the stone inventory of Pueblo

III, IV and V is striking. Even in the assortment of tools and items of household equipment there may be noted extreme simplicity, even crudity. Few of the metates had been carefully shaped, but instead rough slabs were used. Axes were rare, and both axes and hammers lacked the beautiful finish sometimes achieved later. The only abrading tool was the simplest in form, a scrap of sandstone used without special shaping. Chipped points and blades were as skillfully made as later, but they were limited in variety, only two shapes being common. Unshaped flake tools all lacked retouching. If there had been enough digging of early sites to produce several thousand stone artifacts, instead of about 250, a few more traits might have been indicated, but hardly the variety and elaboration of Pueblo V. The emphasis would still have been on simplicity and utility.

In the next few centuries the picture changed hardly at all, as far as stone was concerned, although we know that changes in village arrangement and house plans were occurring. Pueblo III times, however, were marked by many more "luxury" objects, such as beads, tcamahias and slender polished cylindrical stones which may have been nose plugs. Other artifacts of more utilitarian purpose, such as cooking slabs and large stemless blades, also showed a more skillful craftsmanship than previously, a more careful control of technic and a laborious polishing of objects for reasons that must have been mainly esthetic. The same trend continued in Pueblo IV and V. Such pieces of equipment as raised-border palettes and some of the shaftsmoothers were far more carefully made than utility would require. The manufacture of carved stone animals, furthermore, indicates the growth of artistic skill for which there is impressive confirmation in the elaborately painted kiva murals and the delicate designs of Sikyatki Polychrome pottery. The difference is striking between the earliest and latest periods represented by the archæological material, in both technical skill in stone working and in the ratio between objects of strict utility and those for ritual or symbolic purposes. In the next section another equally important difference will be pointed out, the increased specialization of even the most utilitarian objects.

CULTURE CHANGE: VARIETY AND CONTINUITY

Pueblo culture is frequently characterized as conservative and stable, partly because of stubborn Pueblo resistance to Spanish and American innovations and partly because of striking similarities between the material culture of the modern Pueblos and the prehistoric population of the Southwest. But since culture change is difficult to measure or discuss in quantitative terms, the characterization of Pueblo culture as "unchanging" is based on essentially subjective judgments. The relative degree of change in different sectors of culture is somewhat easier to determine, although again it must be done subjectively. Reviewing the stone artifacts of the Jeddito district for the past 12 to 14 centuries two tendencies are discernible. First, increasing specialization and variety, with innovations frequently providing alternative processes and technics without entirely supplanting old ones. Second, an impressive degree of continuity, in contrast to the slow but complete change in architectural practices and pottery styles. The former of these tendencies will be considered first.

A study of table 19 reveals that the stone artifacts of the Jeddito district have become more and more varied with the passage of time. Relatively few forms of implements, once introduced, have failed to persist into the 17th century. For example, of 35 kinds of stone artifacts occurring in Basket Maker III and early Pueblo I, only 6 were not still present in Pueblo V. Of the 10 new traits appearing in Pueblo I and II, 8 persisted into Pueblo V. The result of this is that the inventory of stone artifacts after Pueblo II includes a far greater variety of forms than in the earlier centuries. Some of these new objects served new purposes, in activities or technical processes that probably did not exist before, such as the cooking slabs for making a new kind of corn bread that appeared in Pueblo III, or the loomblocks, cupped stones and carved animals made only after the start of Pueblo IV. But other innovations provided alternative ways of accomplishing old aims. The shaftsmoothers that appeared in Pueblo III were more elaborate tools for the same kind of abrasion of slender wooden objects that had previously been accomplished with simple grooved abraders. The addition of loaf-shaped shaftsmoothers in Pueblo IV involved a further modification and elaboration of technics already in use, while the older kinds of tools continued to be made and used also. Similarly, the introduction of such new hafting methods as the three-quarter groove, the oblique groove and the partial-spiral groove in Pueblo IV increased the number of alternative ways of putting a handle on an axe without greatly changing the processes of getting fire wood or beams for roofs. New shapes of chipped points and blades raised the number of shapes in use from 3 in Basket Maker III-early Pueblo I to 6 in Pueblo III and 12 in Pueblo V.

The impression one gains from this increase in alternative ways of doing the same thing and from the new processes that appear is that many activities were becoming highly specialized. The assortment of stone implements of the earlier horizons was doubtless fully adequate for the needs of the population of those days, and could be produced chiefly by the efforts of the householders who used them. Few, if any, required more than average skill in stone working. By contrast, the equipment of Pueblo IV and V was far less meagre, and in part was probably the product of a few highly skilled workers. We know that even today, for example, only a few women among the Pueblos are considered qualified for the final preparation and installation of cooking slabs. Larger communities and greatly increased economic prosperity make it possible for a society to support such part-time specialists. In addition, equipment can be afforded that is not directly involved in the basic needs of food and shelter. Objects of this sort that appeared in Pueblo III and IV were beads, tcamahias, raised-border palettes, paint grinding stones, carved animals, cupped stones, and slender polished cylindrical stones. Such innovations, both the alternative technics and the "luxury" goods, were made possible by the greater wealth, increased concentration of population and wider trade relations that developed during Pueblo III and subsequently.

It should be mentioned that the compilation of data for table 19 revealed one unsuspected fact, namely, that Pueblo V was marked by hardly any innovations in stone artifacts. Pueblo III and IV each had about a score of new traits, but only five appeared in Pueblo V. Of these, the mica objects were probably brought in or made by the Spanish, and the other traits were evidenced by only eight artifacts, out of nearly 3400 specimens of 17th-century date. The reason for this lack of Pueblo V innovations is not apparent. Factors that may have played a part are the effect of Spanish military and religious activities, and economic or technological changes resulting from the introduction of metal tools. The latter would sharply reduce the need for certain stone tools, and by increasing the availability of wood and the ease of working it would cause substitution of wood for stone in many artifacts. The disturbances in Hopi life resulting from their partial subjugation by the Spanish must have been complex, with repercussions in every aspect of their life. In their arts and crafts one result seems to have been an end of experimentation and innovation, perhaps with an increased value being attached to "the old ways."

From historical data and the extensive architectural remains at Awatovi we know that the Spanish occupation changed the entire town. Hopi traditions record the rise of severe factionalism (progressive or pro-white versus conservative or anti-white) comparable to the Friendlies and the Hostiles at Oraibi at the end of the 19th century. The result was violence, in the revolt of 1680, and civil war, in the "destruction" of Awatovi by other Hopis in 1700 or 1701. Even the economy began to undergo marked changes, although remaining basically agricultural. Domestic animals, metal tools, and (more gradually) wheeled vehicles were introduced. Other changes were made possible or necessary by these three introductions, such as the abandonment of coal as fuel when wood from more distant sources became easily available.

In stone working technics the Hopi learned almost nothing from the Spanish, and produced only three kinds of artifacts that indicate direct Spanish influence. The first is the large stone ring which supported the baptismal font, and was probably made under Spanish direction, since nothing like it had previously been made. The second includes three or four gun flints that may have been made locally to replace flints lost by Spanish soldiers, but this is quite uncertain. If made by the Hopi, supervision and direction would have been needed, since these, too, were of an entirely new form. The third were small pieces of mica, cut into geometric shapes, probably for the decoration of church furnishings, made either by Hopi workmen under Spanish direction, or perhaps by the Spaniards. There are no Hopi stone artifacts known from the 17th century that appear to imitate Spanish objects or indicate changes in technics resulting from contact with European ways. Without the other data, documentary, architectural, etc., the stone artifacts do not even hint of the extent of Spanish influence during the 17th century.

Although the new forms of stone artifacts that resulted from Spanish contact—the gun flints, the mica objects, and the annular support for the font—did not persist, it may be that the conservatism induced by Spanish contact did survive. Today, two and a half centuries after their departure, there are still in use certain types of stone implements that were already respectably old in the 17th century. Tcamahias, carved stone animals, loomblocks, manos and metates, and cooking slabs have changed hardly at all. No doubt other persistent traits would be discovered if ethnographers directed more attention to material culture, and balanced their extensive accounts of esoteric activities with reports on the daily life of the people.

This Pueblo conservatism, however, is by no means a wholly new phenemonon or attributable entirely to Spanish and American contacts. It is the tendency toward continuity and persistence that has already been mentioned. Traits once introduced seldom drop out. Many have persisted for more than a millennium with hardly any modification. This stability involves some of the basic economic activities, such as hunting, agriculture, food preparation, and the technics of producing articles of equipment of both stone and wood. Refinements have been made, but hardly any profound changes since Basket Maker III times. This is in sharp contrast to the impression of endless variation that one gets from a survey of pottery during the 7th to the 17th centuries, or the extensive changes in living quarters that took place during these years. There can be traced a series of small changes leading from the pithouse with its crescent of crude storage chambers to the great communal structures, aggregates of masonry rooms that are still in use. Actually, the pithouse has less similarity to the multi-storied pueblo than it does to the earth lodge of the Upper Missouri. This profound architectural change probably accompanied an equally profound change in the size and composition of social groups. Communities of several hundred were faced with problems in cooperation, planning and regulation that the scattered families and small bands of earlier days had never known. There probably resulted from this a long series of innovations in institutions, and in the routines by which social life was carried on. Of these we have no record, except for the final result, the "social organization" of the modern Pueblos. So far as can be discerned, these changes in the sphere of social regulation do not seem to have been accompanied by any equally great changes or progress in the economic basis of Pueblo society. This is exactly the situation that was mentioned in the Introduction. A great disparity exists in the rate and extent of change in different sectors of the culture. Whether this is an indication of greater conscious concern on the part of the Indians with one sector than with others cannot be known. Our 20th century European-American culture is sometimes characterized as emphasizing innovation in the technological sector at the expense of all others, with the result that we insist on the continuation of many social institutions as nearly unchanged as possible. The reverse might be said of the prehistoric and recent population of the Jeddito district. While they were willing to alter radically their system of social groupings and the institutions by which these groupings carried on their activities, they were content with a relatively simple technology, which changed only slightly and superficially in the course of almost 14 centuries.

APPENDICES A AND B

Appendix A: CHRONOLOGICAL PLACEMENT OF ROOMS AND LEVELS AT AWATOVI

In Chapter I the procedure has been explained by which artifacts found in the fill of Awatovi were assigned to subdivisions of the Pueblo III to V occupation of the site. Here are listed the chronological assignments made and used in this study, except for the omission of those tests and rooms from which no stone artifacts came and for which chronological indications were unsatisfactory.

Wherever the levels of a room's fill were all assigned to the same "period" the separate levels are not listed individually, and where consecutive levels are of the same "period" they are grouped, for example, "0-190" instead of "0-50, 50-100, 100-150, 150-190." Those levels identified by the letters AA or AAA were recorded from special reference points and are here listed as they appear in the field notes.

The following abbreviations are used:

B/W	Pueblo III,	Black-on-white Period
W-O	Pueblo III,	Black-on-white to Black-on-orange Period
B/O	Pueblo III,	Black-on-orange Period
O-Y	Pueblo IV,	Black-on-orange to Black-on-yellow Period
B/Y	Pueblo IV,	Black-on-yellow Period
Y-17	Pueblo IV,	Black-on-yellow to 17th Century
17c	Pueblo V,	17th Century
Unsd	Unassigned	

Room	Period
2	Pueblo IV
18–25	17c
28–39	17c
44 under floor	Pueblo IV
45	Pueblo IV
49	Pueblo IV
56–79	B/Y
80–97	17c
200	Unsd
201	W–O
202, 203	B/O
204, 205	W–O
206	B/O
207	B/W
208–210	B/O
Between 210 and 213	O–Y
211	B/Y
212 0–50	W–O
50–250	B/O
213	O–Y
Between 211 and 213	O–Y
214	B/O
215, 216	O–Y
Between 211 and 216	O–Y
Between 216 and 250	O–Y
217–224	B/Y
225	O–Y
226, 227	B/Y
228	O–Y
229, 230	B/Y
231 fill, north and south	B/Y
231 AA0–100	B/Y
AAA0–50	W–O
AAA50–110	B/O
AAA110–200	W–O
AAA200–274	B/W
232	O–Y
233–237	B/Y
238	O–Y
239 fill	B/Y
floor pit	B/O
240	B/Y
241	O–Y
242	B/Y
243 fill	B/Y
AA0–180	O–Y
244–252	B/Y
253 fill	O–Y
AA0–AAA25	B/O
AAA25–115	W–O
AAA115–270	B/W
254 fill	B/Y
AA0–100	O–Y
AA100–160	B/O
255–261	B/Y
262 top floor	B/Y
top floor–225	O–Y
225–250	B/O
263–273	B/Y
274 0–60	B/Y
60–250	O–Y
south end	O–Y
under stair	O–Y
275, 276	B/Y
277 0–300	B/Y
300–360	O–Y

Room	Period	Room	Period
360–450	B/O	306–308	B/Y
AA150–250	W–O	309	B/O
AA250–360	B/W	310 0–95	B/O
278 0–200	B/Y	AA0–50	W–O
200–250	O–Y	AA50–100	Unsd
279	B/Y	AA100–258	B/W
280 0–190	B/Y	311–313	B/O
190–250	O–Y	314 0–55	Unsd
250–350	B/O	55–145	O–Y
350–390	W–O	315 0–85	Unsd
390–450	B/O	85–135	B/O
AA150–300	W–O	316	O–Y
AA0–255	B/W	317	B/O
281–284	B/Y	318	W–O
285 0–250	B/Y	319 0–250	W–O
250–300	O–Y	250–270	B/W
286, 287	B/Y	320	B/O
288 0–250	B/Y	321 0–100	B/O
250–300	O–Y	100–150	W–O
289, 290	B/Y	150–170	B/W
291 0–150	O–Y	322, 323	Unsd
150–250	B/O	324	B/W
250–280	W–O	325 0–50	B/Y
292 0–150	B/Y	50–100	B/W
150–200	O–Y	100–200	W–O
293 0–100	B/O	200–330	B/W
100–AA50	W–O	326–328	B/W
AA50–100	B/W	329	Unsd
AA100–150	W–O	330	B/W
AA150–268	B/W	400–472	17c
294 0–50	O–Y	473 0–450	17c
50–100	B/O	450–600	B/Y
AA0–255	B/W	474, 475	17c
295 0–50	B/Y	476	B/Y
50–100	O–Y	477–499	17c
296 0–AA125	B/O	500, 500A, 500B	17c
AA125–175	W–O	500C 0–100	17c
AAA0–255	B/W	100–150	Y–17
297 0–45	B/Y	500D	Y–17
45–100	B/O	500E	17c
298 0–150	O–Y	500F 0–50	17c
150–270	B/O	50–100	Y–17
299	B/Y	500G	17c
300	O–Y	500H 0–100	17c
301 0–100	O–Y	100–200	Y–17
100–AA160	B/O	200–250	B/Y
AA160–172	O–Y	500I, 500J, 500K, 500L	17c
AA172–200	W–O	500–508	17c
AA200–270	B/W	509 0–50	17c
A & AA, north end	O–Y	50–100	B/Y
302, 303	B/O	510	17c
Outside north wall of 303	Unsd	511 0–50	17c
304	B/Y	50–100	B/Y
305 0–100	O–Y	512–516	17c
100–200	B/O	517	Unsd
AA0–245	B/W	518–519	17c

Room	Period
520 0–50	17c
50–100	B/Y
521	Y–17
522 0–50	17c
50–200	Y–17
200–250	B/Y
523 0–100	17c
100–250	Y–17
524 0–100	Unsd
100–200	Y–17
525 0–200	17c
200–250	B/Y
526, 527	17c
528 0–50	17c
50–250	Y–17
529 0–150	17c
150–250	Y–17
fill to south	Unsd
cache in south bench	Unsd
530 0–100	17c
100–250	Y–17
600	17c
600A 0–100	17c
100–300	Y–17
600B	Y–17
600C 0–200	Y–17
200–250	B/Y
601–612	17c
613 0–50	17c
50–100	Y–17
614 0–150	17c
150–200	B/Y
615–617	17c
618 0–265	17c
AA0–200	Y–17
AA200–bedrock	B/Y
619–625	17c
626 0–100	17c
100–250	Y–17
626 East end, 0–125	17c
125–150	Y–17
627–632	17c
700–799	17c
800	17c
801	B/Y
802, 803	17c
804, 805	Y–17
806, 807	B/Y
808	Unsd
809	17c
810 0–50	17c
50–100	Y–17
811 0–50	17c
50–100	Y–17

Room	Period
812, 813	Y–17
814	17c
815	Y–17
816, 817	17c
818–820	Y–17
821	B/Y
822 0–50	17c
50–82	Y–17
823–826	17c
827	B/Y
828 0–150	17c
150–190	Y–17
829–835	17c
900–999	17c
Tests 1–6	17c
Test 7	
1	B/Y
2 0–40	Unsd
40–350	B/Y
350–400	O–Y
400–500	B/O
500–bedrock	W–O
Test 8	B/Y
Test 9	O–Y
Test 10	B/Y
Test 11	
1	B/Y
2 0–100	B/Y
100–200	B/O
200–250	W–O
floor	B/O (?)
Tests 12, 13	B/Y
Test 14	
1 0–50	17c
50–100	B/Y
2, 3	B/Y
4 0–200	Y–17
below floor	B/Y
east alcove	B/Y
under bench	Y–17
5 0–165	Y–17
ventilator, floor, sipapu, pit in southwest corner	Y–17
6 0–150	Y–17
niche	B/Y
7	B/Y
10 (main)	O–Y
south bench	B/O
east bench	O–Y
Test 15	
1 0–80	Unsd
80–150	O–Y
2 0–100	O–Y
100–195	B/O
Test 16 0–95	B/O
95–115	B/W

Room	Period
Test 17 0–95	B/Y
95–195	B/O
Test 18 0–150	B/Y
150–170	B/O
170–210	W–O
Test 19	
1	B/Y
2	Unsd
3, 4	Y–17
Test 20 0–200	B/Y
200–250	B/O
Test 21	B/Y
Test 22	
Squares A–K	17c
1 0–150	17c
150–AA100	B/Y
2, 3, 4	17c
5 0–150	17c
150–AAA150	B/Y
around cist	B/Y
6–11	17c
Kiva I	17c
Test 23	
1	B/Y
2 0–30	B/Y
30–93	O–Y
93–135	W–O
135–185	B/W
Test 24	Unsd
Test 25	B/Y
Test 26	
1	B/Y
2 0–200	B/Y
200–250	O–Y
250–400	B/O
banquette	B/Y
Test 27	
1, 2	B/Y
3 0–150	B/Y
150–200	O–Y
200–400	B/O
400–floor	W–O
Test 28	
1 0–250	17c
250–300	Y–17
300–304	B/Y
2, 3	17c
4	Y–17
Test 29	Unsd
Test 30 0–45	17c
45–320	Y–17
320–375	B/Y
Test 31	
1	17c
2 0–50	Y–17
150–180	17c
3	Y–17
4 0–100	Y–17
100–183	17c
Test 32	Y–17
Test 33	
1, 2	17c
3	Unsd
4	Y–17
5, 6, 7	17c
Test 34 0–200	Y–17
200–350	B/Y
pit at east end	B/Y
Test 35	Y–17
Test 36	
1 0–35	17c
35–57	Y–17
2	17c
3	B/Y
4, 5	Unsd
6 0–100	Y–17
100–128	B/Y
7	B/Y
Test 37 0–225	Y–17
225–248	B/Y
Test 38	17c
Test 39 0–100	17c
100–200	B/Y
Test 40	
1	Y–17
2	17c
3 0–75	17c
75–125	Y–17
Test 41	
1	17c
2 0–100	17c
100–210	Y–17
3	B/Y
Test 42 0–200	17c
200–250	Y–17
250–343	B/Y
Test 43	17c
Test 44	
1	17c
2 0–50	17c
50–100	Y–17
Test 45	
1 0–50	17c
50–150	Y–17
2	17c
Test 46	
1, 2, 3	17c
4	Unsd
5	Y–17
6, 7	17c
Test 47	17c

Room		Period
Test 48		17c
Test 49		Y–17
Test 50		17c (?)
Test 51		
1	0–50	B/Y
	50–100	Y–17
2		Y–17
3	0–100	Y–17
	100–130	17c
4	0–50	Y–17
	50–137	B/Y
5		Y–17
6		B/Y
7		Y–17
8		B/Y
9, 10		Y–17
11	0–50	B/Y
	50–110	Y–17
12		Y–17
13	0–50	Y–17
	50–100	B/Y
14	0–50	B/Y
	50–100	Y–17
15		17c
16, 17		Y–17
Test 52		
A, B, C		B/Y
D		Y–17
1, 2, 3		Y–17
4	0–50	Y–17
	50–65	17c
5	0–50	Y–17
	50–60	B/Y
6, 7		Y–17
8	0–100	Y–17
	100–125	B/Y

Room		Period
9		Y–17
Test 53		Unsd
Test 54	0–50	Y–17
	150–200	B/Y
Test 55		
1		Unsd
2		Y–17
3	0–50	Y–17
	50–100	B/Y
4		B/Y
5, 6		Y–17
7	0–50	B/Y
	50–100	Y–17
8		Y–17
9	0–50	17c
	50–100	Y–17
10, 11		Y–17
12, 13		B/Y
Test 56	0–250	Y–17
	250–450	B/Y
Test 57		Y–17
Test 58		
1		B/Y
2	0–50	Y–17
	50–100	B/Y
3		B/Y
Unnumbered room		Y–17
Test 59		Y–17
Test 60		B/Y
Test 61		17c
Test 62	0–150	Y–17
	150–200	B/Y
Test 63		17c
Test 64		Y–17
Test 65		Y–17

Appendix b: PROVENIENCE OF ARTIFACTS FOUND ON FLOORS, IN NICHES, ETC.

Artifact	Site	Test and Room		Location	Period
Axe, ¾ grooved, reused	Awatovi	—	35	floor	PV
Axe, ¾ grooved, reused, stained red	Awatovi	—	248	floor	PIV (B/Y)
Axe, ¾ grooved, reused	Awatovi	—	403	floor	PV
Axe, ¾ grooved, reused	Awatovi	—	450	floor	PV
Axe, ¾ grooved, reused	Awatovi	24	4	floor	Unassigned
Axe, ¾ grooved, double-bitted	Awatovi	—	59	floor	PIV (B/Y)
Axe, full grooved, reused	Awatovi	14	5	sipapu	PIV (Y-17)
Axe, full grooved, reused	Awatovi	—	22	floor	PV
Axe, full grooved, reused (as grinding stone)	Awatovi	—	248	floor	PIV (B/Y)
Hammer, ¾ grooved	Awatovi	5	—	in niche in south wall	PV
Metate, troughed with shelf at closed end	264	—	19	floor	BMIII–early PI
Metate, troughed with shelf at closed end	264	—	16	standing against wall	BMIII–early PI
Metate, troughed with shelf at closed end	Awatovi	—	243	used to plug door	PIII or IV
Two metates, troughed, open at one end	4A	—	18	both on floor, one turned over	BMIII
Metate, troughed, open at one end	4A	—	21	floor	PII
Metate, troughed, open at one end	104	—	2	floor	PII–III
Metate, troughed, open at both ends	4A	—	24	floor	BMIII
(Imprint of metate in bin)	104	—	13	near north wall	PI–III
(Three empty metate bins)	4	in open		—	PIII
Flat metate	Pink Arrow	—	14	on floor	PIII–IV
Flat metate	Pink Arrow	—	19	on floor	PIII–IV
Flat metate	Pink Arrow	—	23	on floor	PIII–IV
Flat metate	Awatovi	—	296	set on edge	PIII (B/O)
Flat metate (and fragment of another)	Awatovi	—	243	used to plug door	PIII–IV
Flat metate	Awatovi	26	1	on floor	PIV (B/Y)
Flat metate	Awatovi	between 626 and 627		used in wall	PIV (Y-17)
Flat metate	Awatovi	33	7	set on end	PV
Two flat metates	Awatovi	—	601	set on end	PV
Two flat metates	Awatovi	5	—	leaning against wall	PV
Four flat metates	Awatovi	5	—	stacked on floor	PV

Artifact	Site	Test and Room		Location	Period
Two flat metates (one fragmentary)	Awatovi	—	503	on floor	PV
Flat metate	Awatovi	28	1	on floor in bin	PV
Flat metate	Awatovi	—	501	on floor	PV
Flat metate	Awatovi	6	—	on floor	PV
Flat metate	Awatovi	Church 2		with burial #79	PV
Mano, convex surface	264	—	19	on floor with metate	BMIII–early PI
Two manos, convex surface	4A	—	18	on floor with metates	BMIII
Mano, convex surface	4A	—	21	on floor with metate	PII
Mano, convex surface	Awatovi	—	330	used as building stone	PIII (B/W)
Three manos, 1 g.s.	4A	—	18	on floor	BMIII
Mano, 1 g.s.	4A	—	1	on floor	PI
Mano, 1 g.s.	4A	—	6	on floor	PII
Four manos, 1 g.s.	102	—	2	on or near floor	PII
Mano, 1 g.s.	Awatovi	—	lower 207	on floor	PIII (B/W)
Mano, 1 g.s.	Awatovi	—	312	in masonry	PIII (B/W)
Mano, 1 g.s.	Awatovi	—	303	on floor	PIII (B/W)
Mano, 1 g.s.	Awatovi	26	(50–100 cm)	with fitting metate, in fill	PIV (B/Y)
Two manos, 1 g.s.	Awatovi	—	36	on floor	PV
Mano, 1 g.s.	Awatovi	46	1	in southeast corner bin, with three metates	PV
Mano, 1 g.s.	Awatovi	—	515	on floor	PV
Two manos, 1 g.s.	Awatovi	5	—	set in floor at fireplace	PV
Two manos, 1 g.s.	Awatovi	5	—	in niche in south wall	PV
Two manos, 1 g.s.	Awatovi	5	—	on floor	PV
Mano, 1 g.s.	Awatovi	—	402	on floor	PV
Mano, 1 g.s.	Awatovi	—	403	on floor	PV
Mano, 2 adj. g.s.	Awatovi	—	330	in masonry	PIII (B/W)
Mano, 2 adj. g.s.	Awatovi	—	59	on floor	PIV (B/Y)
Mano, 2 adj. g.s.	Awatovi	5	—	on floor	PV
Mano, 2 adj. g.s.	Awatovi	—	403	on floor	PV
Two manos, 2 opp. g.s.	107	—	11	in fill of ventilator shaft	PIII ?
Mano, 2 opp. g.s.	Awatovi	—	2	on floor	PIV (B/Y)
Mano, 2 opp. g.s.	Awatovi	7	2	on 200 cm. floor	PIV (B/Y)
Mano, 2 opp. g.s. (fgt.)	Awatovi	14	5	on floor	PIV (Y–17)
Mano, 2 opp. g.s.	Awatovi	46	1	in southeast corner bin, with three metates	PV
Mano, 3 g.s.	Awatovi	—	261	on floor	PIV (B/Y)
Mano, 3 g.s.	Awatovi	7	2	on 200 cm. floor	PIV (B/Y)
Mano, 3 g.s.	Awatovi	—	59	on floor	PIV (B/Y)
Mano, 3 g.s.	Awatovi	44	1	on floor	PV
Mano, 3 g.s.	Awatovi	—	36	on floor	PV
Manos, 3 g.s. (fgt.)	Awatovi	—	486	in pit under floor	PV
Two manos, 3 g.s.	Awatovi	24	Sq. C–D	on floor	Unassigned

Artifact	Site	Test	Room	Location	Period
Mano, 4 g.s.	Awatovi	—	59	on floor	PIV (B/Y)
One-hand mano	4, Unit B	West room		on floor	PII
One-hand mano	4A	D-shaped kiva		on floor	PII
One-hand mano	102	—	2	on floor	PII
One-hand mano	Awatovi	between	277 and 280	used as building stone	PIII (B/W)
One-hand mano	Awatovi	14	5	in sipapu (in fill?)	PIV (Y–17)
One-hand mano	Awatovi	5	—	in fireplace	PV
One-hand mano	Awatovi	—	606	in fill with grinding slab fragment	PV
One-hand mano	Awatovi	—	36	on floor	PV
Pecking stone	4A	—	18	on floor	BMIII–early PI
Pecking stone	264	—	16	on bench, northwest side	BMIII–early PI
Two pecking stones	4	D-shaped kiva		on floor	PII
Two pecking stones	Awatovi	14	4	in "cache" jar in south bench	PIV (Y–17)
Pecking stone	Awatovi	14	5	in "cache" jar in northwest bench	PIV (Y–17)
Four pecking stones	Awatovi	14	5	cache in southwest corner	PIV (Y–17)
Four pecking stones	Awatovi	—	788	in fill (offerings?)	PV
Pounding and rubbing stone	264	—	30	on bench	BMIII–early PI
Two pounding and rubbing stones	4A	—	18	on floor	BMIII–early PI
Pounding and rubbing stone	4	D-shaped kiva		on floor	PII
Pounding and rubbing stone	Pink Arrow	—	6	niche in east wall	PIII–IV
Five pounding and rubbing stones	Awatovi	14	5	cache in southwest corner	PIV (Y–17)
Pebble pounder	Awatovi	—	486	in sealed pit under floor	PV
Pebble pounder	Awatovi	Church 2		possibly associated with burial #64	PV
Pebble pounder	Kawaika-a	4	7	in niche	PIII–IV
Discoidal hammerstone	Awatovi	—	324	on floor	PIII (B/Y)
Paint grinding stone	Awatovi	—	753	on floor with slab and malachite	PV
Paint grinding stone	Kawaika-a	5	2	fill (50–100) with slab	PIV–V
Paint grinding stone	Awatovi	—	59	on floor with slab and malachite	PIV (B/Y)
Five simple grooved abraders	264	—	16	in floor hole	BMIII–early PI

Artifact	Site	Test and Room		Location	Period
Simple grooved abrader	Awatovi	14	5	in pot set into bench in northwest corner	PIV (Y-17)
Raised-border palette	Awatovi	—	434	on floor	PV
Grinding slab	Awatovi	—	465	on floor with pigment	PV
Grinding slab	Awatovi	—	753	on floor with paint grinding stone and malachite	PV
Grinding slab	Awatovi	33	4	on floor	PIV (Y-17)
Grinding slab	Kawaika-a	5	2	in fill (50–100) with grinding stone	PIII–IV
Grinding slab	264	—	16	in floor hole	BMIII–early PI
Roughly-shaped mortar	Awatovi	—	419	on floor	PV
Two roughly-shaped mortars	264	—	34	on east bench	BMIII–early PI
Symmetric stemless blade, round base	Awatovi	—	778	in fill (offering ?)	PV
Straight based side notched point (stem wider than shoulder)	Awatovi	Church 2		with burial #89	PV
Side notched point, stem narrower than shoulder	Awatovi	Church 2		with burial #97	PV
Side notched point, stem narrower than shoulder	Awatovi	—	734	on floor	PV
Flake, retouched on both faces	Awatovi	14	10	on floor	PIV (O-Y)
Flake, retouched on both faces	Awatovi	14	4	in pot set in floor under paving	PIV (B/Y)
Two flake tools, no retouch	264	—	30	on bench	BMIII–early PI
Three flake tools, no retouch	Awatovi	14	5	in pot under northwest bench	PIV (Y-17)
Flake, retouched on one face	Awatovi	14	5	in pot under northwest bench	PIV (Y-17)
Turquoise bead	Awatovi	31	1	on floor	PV
Small beads, over 4200	241	eroded burial		probably around right arm	PIII
Mica objects and fragments	Awatovi	Church 2		on floor at altar steps	PV
Mica objects and fragments	Awatovi	—	241	on floor #1	PV
Two green stone inlay(?) fragments	264	—	16	1 on floor, 1 on bench	BMIII–early PI
Spatulate limestone object	264	—	16	on bench	BMIII–early PI
Turquoise fragment	Awatovi	—	788	on floor in front of ventilator	PV
Pair of loomblocks	Awatovi	—	788	in fill (offerings ?)	PV
Two pairs of loomblocks and one single	Awatovi	31	1	on floor	PV

Artifact	Site	Test and Room		Location	Period
Two pairs of loomblocks	Awatovi	22	10	on benches	PV
Loomblock	Awatovi	—	Kiva A	on floor with perforated slab	PV
Pair of loomblocks	Awatovi	44	1	on floor	PV
Loomblock	Awatovi	—	454	on floor	PV
Loomblock	Awatovi	—	406	on floor	PV
Loomblock	Awatovi	—	510	on floor	PV
Loomblock	Awatovi	—	601	on floor	PV
Loomblock	Awatovi	—	734	on floor	PV
Carved quadruped	Awatovi	Church 2		on left chest of burial #83	PV
Carved quadruped	Awatovi	14	5	in cache under southwest bench	PIV
Carved quadruped	Awatovi	Church 2		with burial #51	PV
Four carved building stones	4	late PIII unit		on outer face of south wall	Late PIII
Incised slab	Awatovi	between 436 and 785		used to plug door	PV
Incised paving slabs	Awatovi	—	529	on south bench	PIV (Y-17)
Seventeen stone balls	Awatovi	14	5	in cache under southwest bench	PIV
Two stone balls	Awatovi	31	1	in base of ventilator shaft	PV
Eight stone balls	Awatovi	—	788	4 in fill, 4 in horizontal section of ventilator	PV
Cooking slab	Pink Arrow	—	2	leaning against east wall	PIII–IV
Three grooved weights (?)	Awatovi	14	5	in cache under southwest bench	PIV
Flat polishing pebble	Awatovi	—	465	with burial #92, under jaw	PV
Thick cylindrical stone	Awatovi	Church 2		with burial #79	PV
Slender polished cylindrical stone	Awatovi	24	Sq. E	with burial #15, beside leg	PIV or V
Two small boulders	Awatovi	14	5	in cache under southwest bench	PIV (Y-17)
Annular support for baptismal font	Awatovi	—	465	on floor	PV
Nine spherical concretions	Awatovi	14	5	in cache under southwest bench	PIV (Y-17)
Spherical concretion	Awatovi	—	772	with burial #104	PV
Four irregular concretions	Awatovi	14	5	in cache under southwest bench	PIV (Y-17)
Irregular concretion	Awatovi	Church 2		with burial #75	PV
Sliver of petrified wood	Awatovi	Church 2		with burial #85	PV

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COLLOTYPE FIGURES 14–41

Explanatory and descriptive details of the field catalogues have been omitted here. In tests consisting of a single room the number (invariably Room 1) is omitted. Levels are given as "100–150" instead of "100 to 150 centimeters." When a room was recorded as a single level, the "0–50," "0–floor," etc., is omitted. Directions are abbreviated as N, S, E, and W. Levels preceded by AA or AAA were measured from supplementary reference points, usually below the original point A.

The catalogue numbers are those of Peabody Museum, Harvard University, unless otherwise indicated.

FIGURE 14
THREE-QUARTER AND FULL-GROOVED AXES

Three-quarter grooved axes (*a–l*):

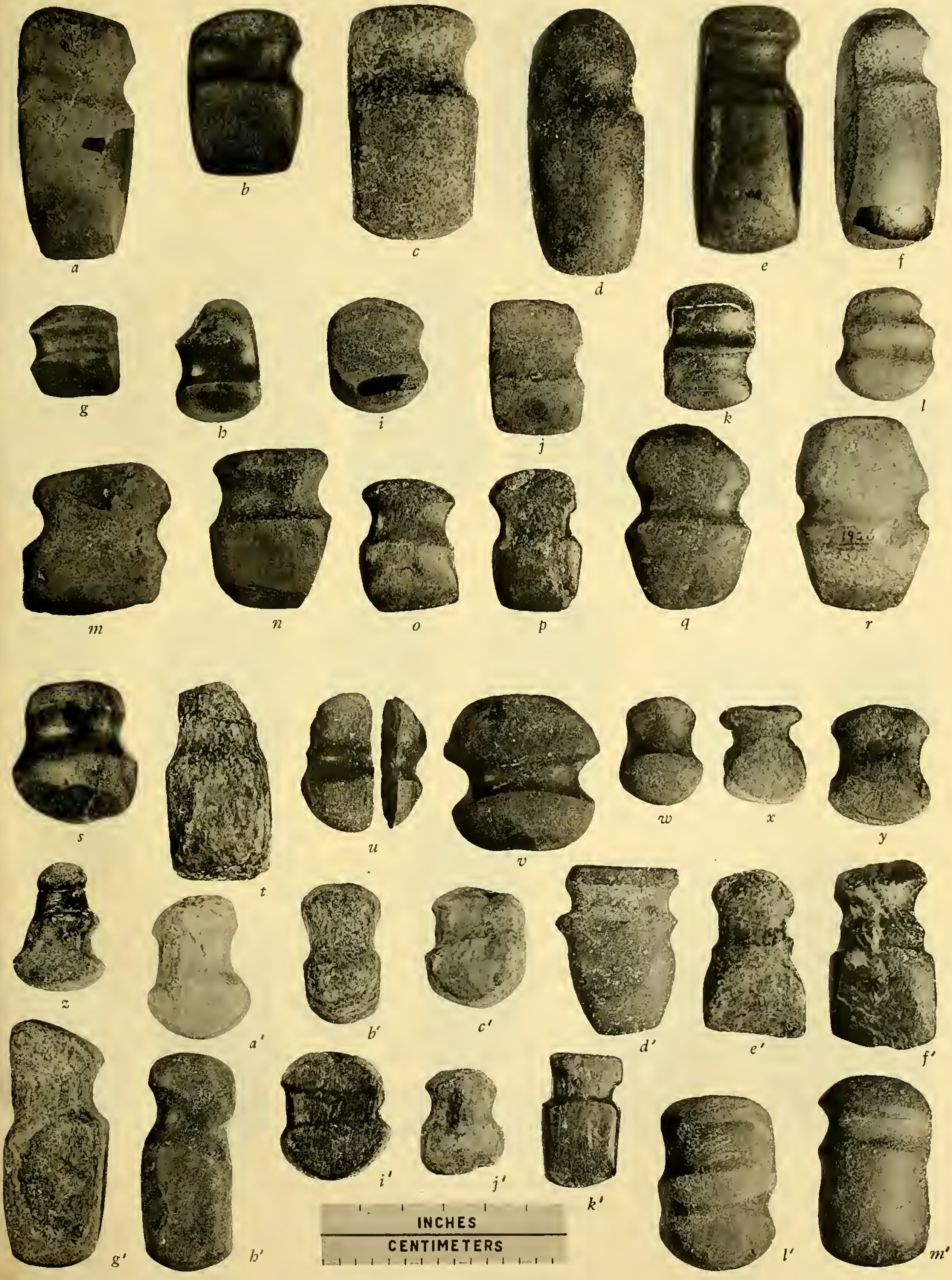
a–b,	Unmodified (i. e., still sharp).
c–d,	Re-used as hammers.
e,	Regrooved, with three-quarter groove in same relative position.
f,	Lipped.
g,	Unmodified (i. e., still sharp).
h–i,	Re-used as hammers.
j,	Double-bitted.
k,	Regrooved, with three-quarter groove in reverse position.
l,	Regrooved, with full groove.

Full grooved axes (*m–m′*):

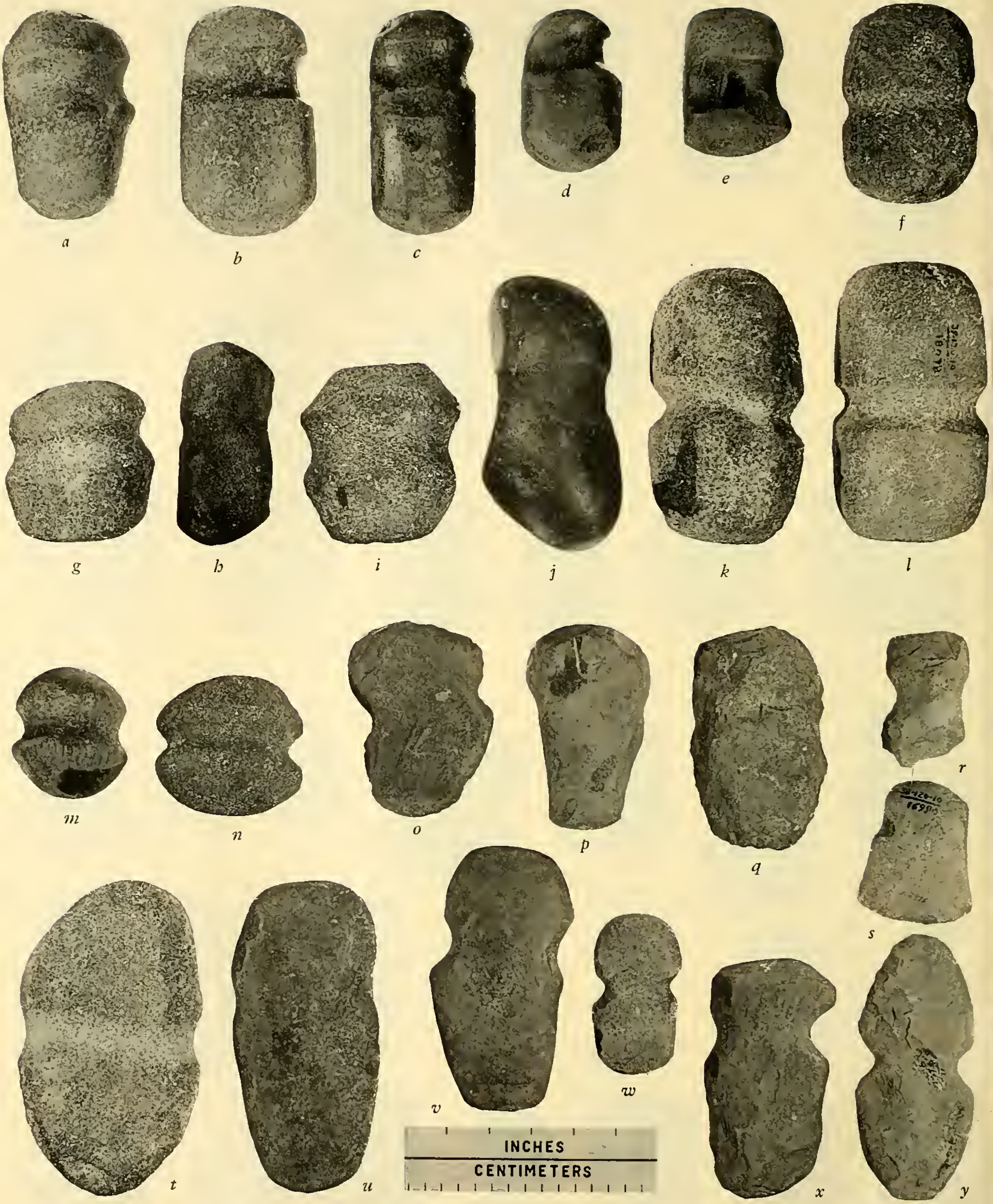
m–r,	Unmodified (i. e., still sharp).
s–y,	Re-used as hammers (only the larger part of *u* was used after it split).
z,a′–b′,	Oblique groove.
c′,	Partial-spiral groove.
d′–f′,	Regrooved, with full groove.
g′–h′,	Oblique spiral.
i′,	Partial-spiral groove.
j′–k′,	Re-used as hammers.
l′–m′,	Regrooved, with three-quarter groove.

	Provenience			Catalogue Number
a,	Awatovi,	Test 60, Room 1, 50–100	Pueblo IV	39–97–10/19729
b,	"	Room 307, 150–200	"	36–131–10/8463
c,	"	Room 611, 50–100	Pueblo V	37–111–10/11783
d,	"	Room 403, floor	"	37–111–10/11756
e,	"	Test 46, Room 3, 0–50	"	39–97–10/19713
f,	"	Test 52, Room 4, 50–65	"	39–97–10/19721
g,	"	Test 64, 0–100	Pueblo IV	39–97–10/19732
h,	"	Surface	Unassigned	38–120–10/16994
i,	"	Test 64, 0–100	Pueblo IV	39–97–10/19748
j,	"	Room 59, floor	"	35–126–10/5770
k,	"	Room 788, 100–150	Pueblo V	38–120–10/16951
l,	"	Test 55, Room 5, 0–50	Pueblo IV	39–97–10/19742
m,	Awatovi,	Room 307, 150–200	Pueblo IV	36–131–10/8464
n,	"	Room 271	"	36–131–10/8457
o,	Pink Arrow,	Room 31, 125–175	Pueblo III–IV	39–97–10/20144
p,	Awatovi,	Room 809, 50–100	Pueblo V	38–120–10/16954
q,	"	Test 51, Room 8, 50–100	Pueblo IV	39–97–10/19716
r,	"	Room 243 in wall, AA 100	"	36–131–10/8454
s,	"	Room 294, AA 50–100	Pueblo III	36–131–10/8485
t,	"	Test 51, Room 13, 0–50	Pueblo IV	39–97–10/19719
u,	"	Room 489, 150–200, and		38–120–10/16935
		Room 435, 0–50	Pueblo V	37–111–10/11762
v,	"	Room 22, floor	"	35–126–10/5753
w,	"	Room 719, 50–100	"	38–120–10/17092
x,	"	Room 474, 100–150	"	38–120–10/16930
y,	"	Room 408, 0–50	"	37–111–10/11757
z,	"	Room 620, 50–100	"	37–111–10/11794
a′,	"	Room 478, 40–75	"	38–120–10/16933
b′,	"	Room 613, 0–50	"	37–111–10/11785
c′,	"	Room 526, 200–250	"	37–111–10/11777
d′,	Site 169,	Room 2	Pueblo II	39–97–10/20429
e′,	Awatovi,	Test 51, Room 13, 0–50	Pueblo IV	39–97–10/19718
f′,	"	Room 814, 0–50	Pueblo V	38–120–10/16959
g′,	"	Test 44, Room 1, floor	"	38–120–10/16989
h′,	"	Room 709, 50–100	"	38–120–10/17317
i′,	"	Test 5	"	36–131–10/8468
j′,	"	Room 438, 50–100	"	37–111–10/11808
k′,	"	Test 33, Room 6, 0–39	"	38–120–10/16981
l′,	"	Room 824, 0–50	"	38–120–10/16961
m′,	"	Test 46, Room 1, under floor slab on E side	"	39–97–10/19712

NOTE: The following axes are of sillimanite schist, and were probably imported from the Rio Grande; *o, p, t, x, y, g′, i′, j′ k′*. Others are mostly of basalt, probably obtained locally.



Three-Quarter and Full-Grooved Axes.



Three-Quarter and Full-Grooved Hammers, Notched Axes and Hammers, Grooved and Notched Manos.

Figure 15

THREE-QUARTER AND FULL-GROOVED HAMMERS, NOTCHED AXES AND HAMMERS, GROOVED AND NOTCHED MANOS

a–e,	Three-quarter grooved hammers.
f,	Oval full-grooved hammer.
g–j,	Irregular full-grooved hammers.
k, l,	Oval full-grooved hammers.
m, n,	Spherical full-grooved hammers (war clubs?).
o,	Notched axe.
p,	Notched hammer.
q,	Unfinished axe (?).
r, s,	Notched axes.
t, u,	Grooved and notched manos (for hafting?).
v–y,	Notched axes.

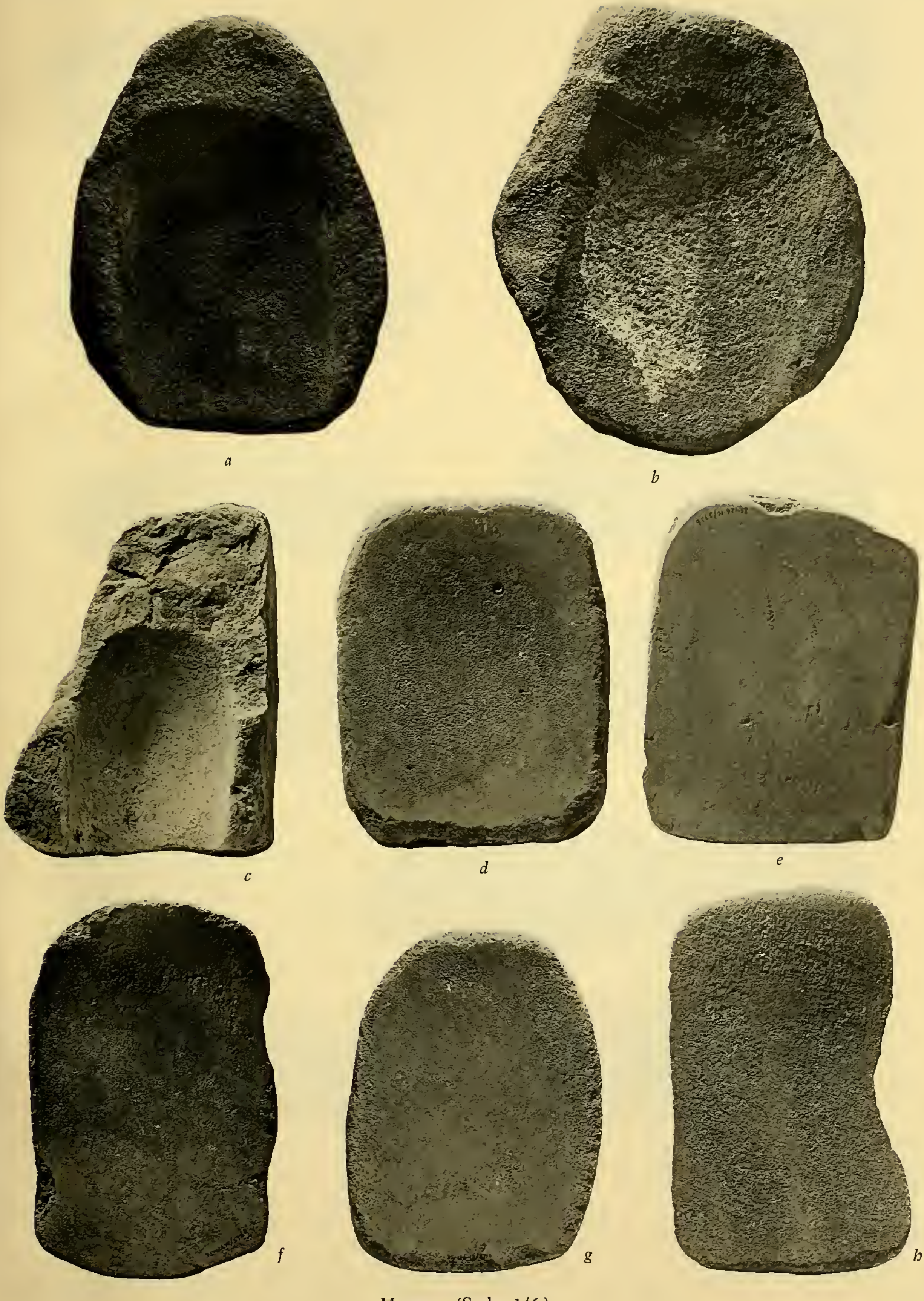
	Provenience			Catalogue Number
a,	Awatovi,	Test 5, niche in S wall	Pueblo V	36–131–10/8486
b,	"	Room 709, 0–40	"	39–97–10/19710
c,	"	Room 520, 50–100	Pueblo IV	37–111–10/11774
d,	"	Test 31, Room 1, floor	Pueblo V	38–120–10/16975
e,	"	Test 14, Room 4, 150–200	Pueblo IV	37–111–10/11797
f,	"	Room 905, 0–40	Pueblo V	39–97–10/19735
g,	Site 264,	Room 30, on bank	Basket Maker III–early Pueblo I	39–97–10/20470
h,	Awatovi,	Room 39, 0–100	Pueblo V	35–126–10/5748
i,	Jeddito area,	Surface	Unassigned	37–111–10/11804
j,	Site 264,	Room 30, 100–125	Basket Maker III–early Pueblo I	39–97–10/20471
k,	"	Room 264, Room 16, 0–100	"	39–97–10/20469
l,	Site 4A,	Surface	"	38–120–10/18078
m,	Site 106,	Room 3, firepit	Pueblo III	39–97–10/20369
n,	Awatovi,	Room 456, 80–115	Pueblo V	38–120–10/17048
o,	Site 107	Room 3, floor	Pueblo I–III	39–97–10/20370
p,	Awatovi,	Room 819, 0–50	Pueblo IV	38–120–10/17077
q,	Site 263,	Room 1, 60–125	Pueblo I–II	39–97–10/20450
r,	Awatovi,	Surface	Unassigned	39–97–10/19733
s,	"	Surface	"	38–120–10/16990
t,	Site 104,	Room 2	Pueblo II–III	39–97–10/20353
u,	Awatovi,	Room 905, 0–40	Pueblo V	39–97–10/19734
v,	"	Room 296, in N wall	Pueblo III	36–131–10/8462
w,	"	Test 37, Room 1, 175–225	Pueblo IV	38–120–10/16984
x,	"	Trench I, top fill	Unassigned	35–126–10/5771
y,	"	Room 296, AA 125–175	Pueblo III	36–131–10/8461

FIGURE 16

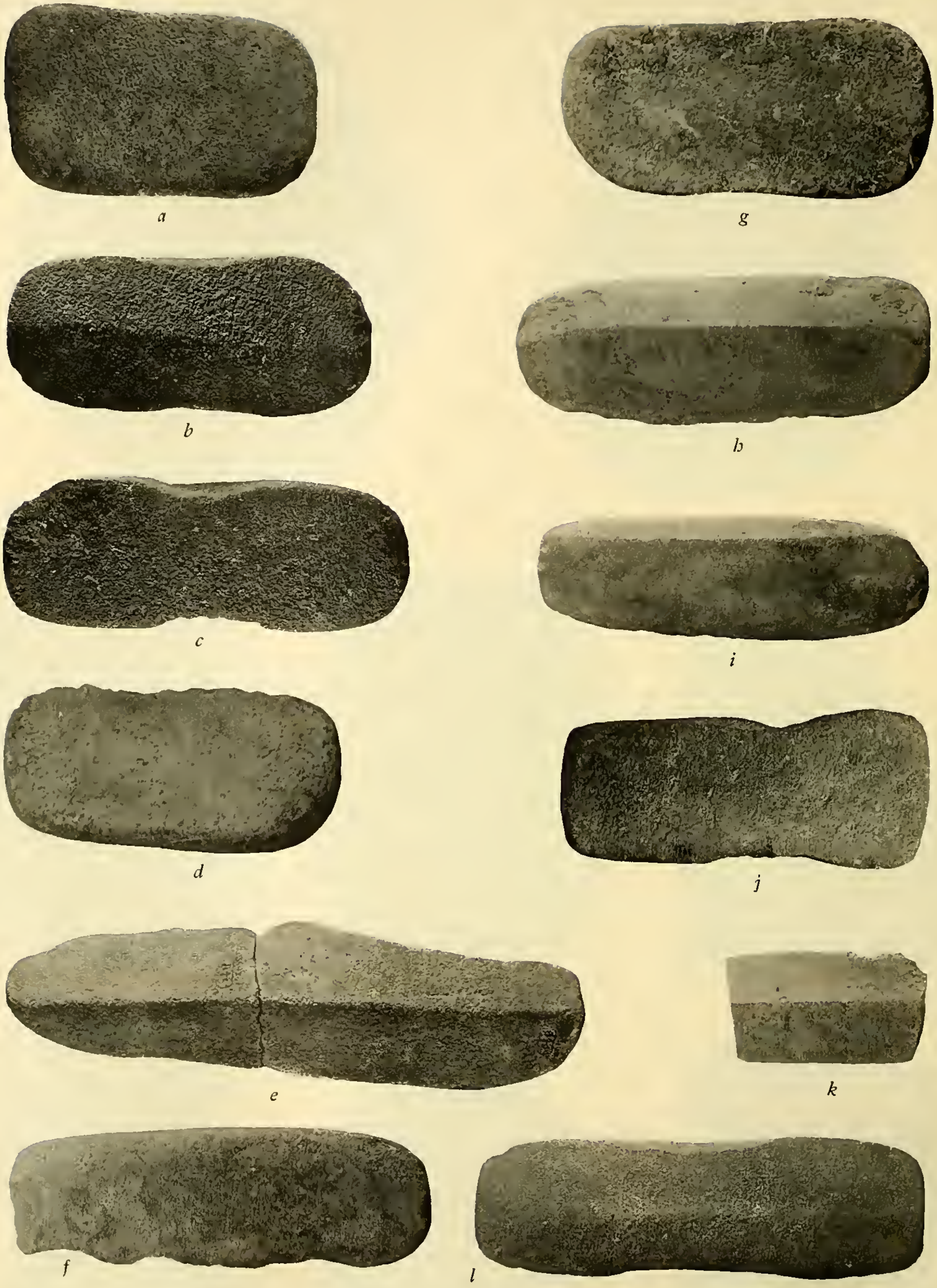
METATES

a–b,	Troughed metates, with shelf at closed end, sometimes called "Utah Type."
c,	Troughed metates, with one end open.
d–h,	Flat metates. Note the pecking of the grinding surface of *e,* to roughen it.

	PROVENIENCE			CATALOGUE NUMBER
a,	Site 264,	Room 16, leaning against wall W of southern recess	Basket Maker III–early Pueblo I	39–97–10/20492
b,	"	Room 19, on floor	"	39–97–10/20493
c,	Site 4A	Room 18, on floor	Basket Maker III	39–97–10/20316
d,	Awatovi,	Room 57	Pueblo IV	35–126–10/5709
e,	"	Room 24	Pueblo V	35–126–10/5706
f,	"	Room 15	"	35–126–10/5704
g,	"	Room 39	Pueblo IV	35–126–10/5710
h,	"	Room 85	Pueblo V	35–126–10/5707



Metates. (Scale: 1/6.)



Manos. (Scale 1/4.)

FIGURE 17

MANOS

Convex manos, for use with troughed metates (*a–b*).

a, Grinding surface of typical specimen.

b, Pair of flat grinding surfaces on face shown; convex surface below. These flat surfaces were probably worn by later use on a flat metate.

Flat manos, for use with flat metates (*c–l*).

c–d, Single grinding surface. Note finger grips on *c*.

e–f, Two adjoining grinding surfaces, the upper one on *f* extremely narrow, nearly obliterated.

g–h, Two opposite grinding surfaces. On *g*, parallel; on *h*, not parallel, with only part of surface occupied by grinding surface.

i–j, Three grinding surfaces. Clearly distinguished on *i*, but very poorly defined on *j*.

k–l, Four grinding surfaces. Note finger grips on *l*.

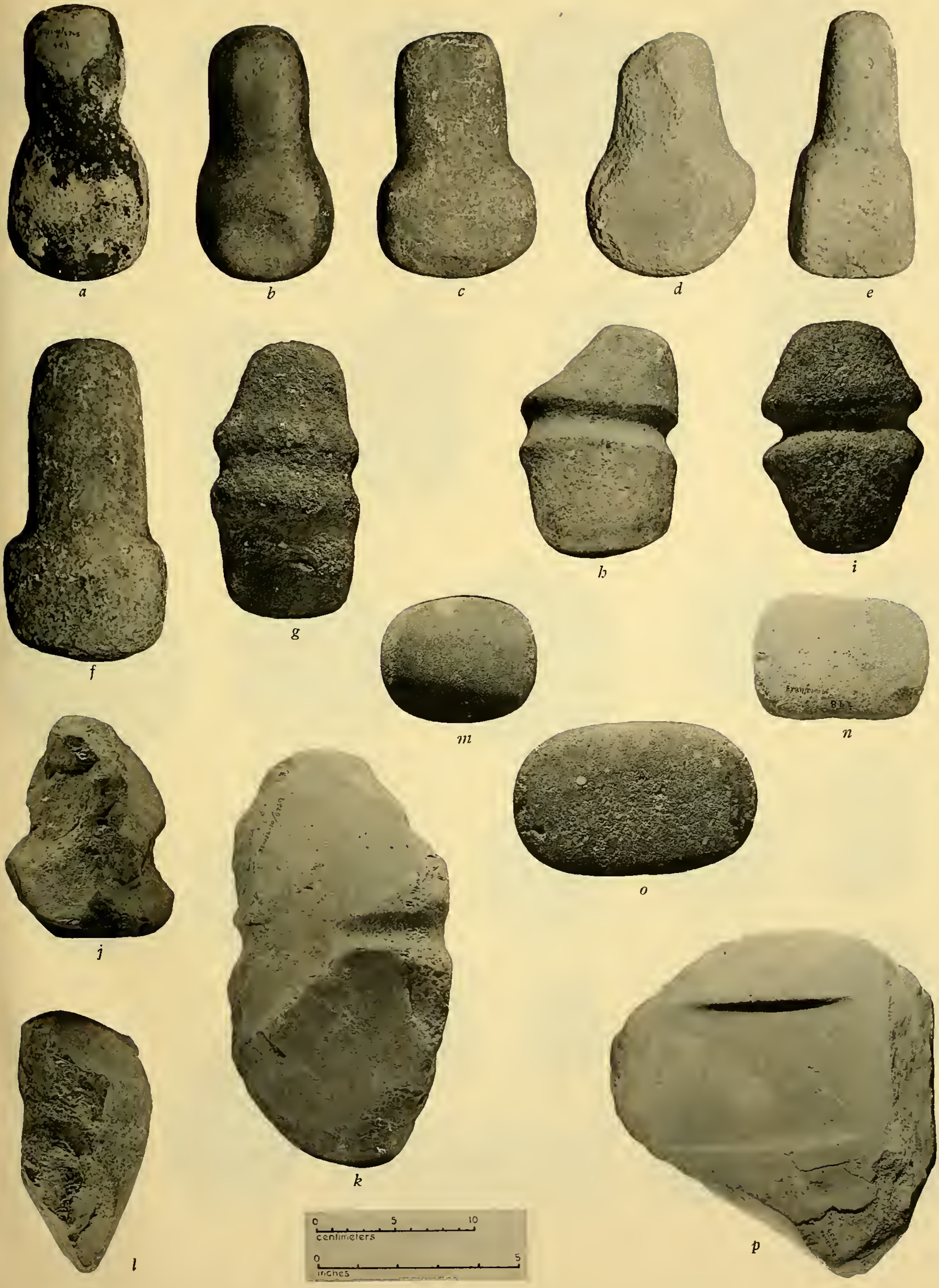
	PROVENIENCE			CATALOGUE NUMBER
a,	Site 4A,	Room 18, on floor	Basket Maker III	39–97–10/20320
b,	Awatovi,	Room 238	Pueblo IV	36–131–10/8359
c,	"	Room 34	Pueblo V	35–126–10/5713
d,	"	Room 800, 0–60	"	38–120–10/17300
e,	"	Room 296, 70–125	Pueblo III	36–131–10/8404
f,	"	Test 5, on floor near S wall	Pueblo V	36–131–10/8425
g,	"	Room 801, 0–40	Pueblo IV	38–120–10/17289
h,	"	Room 85	"	35–126–10/5733
i,	"	Room 419, 50–100	Pueblo V	37–111–10/11820
j,	"	Room 261, floor	Pueblo IV	36–131–10/8378
k,	"	Room 49, 0–100	Pueblo V	35–126–10/5725
l,	"	Room 73, 50–100	Pueblo IV	35–126–10/5730

Figure 18

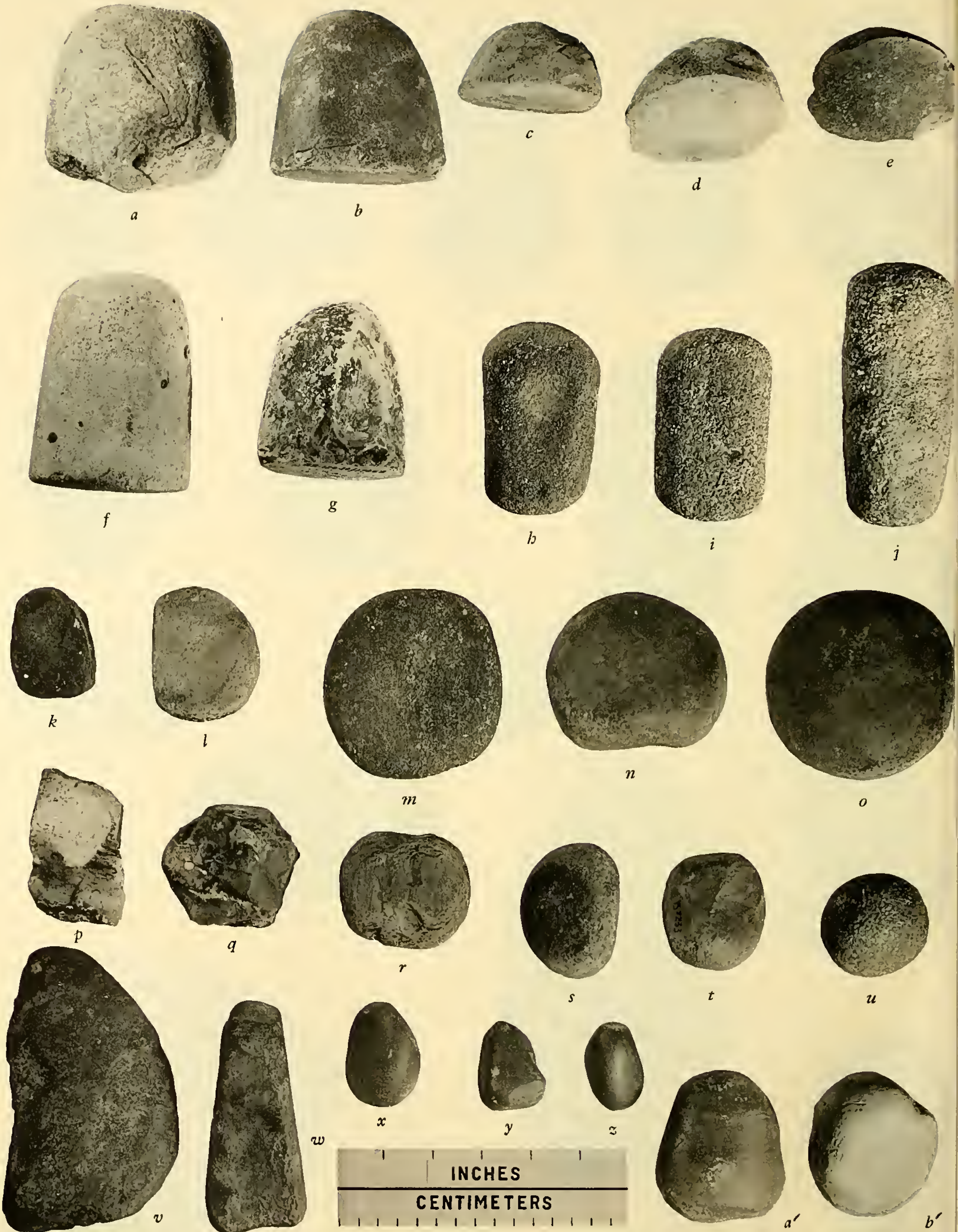
PESTLES, FULL-GROOVED LIPPED HAMMERS, NOTCHED HAMMERS, ONE-HAND MANOS, MINIATURE METATE

a–f,	Pestles.
g–i,	Full-grooved lipped hammers.
j, k, l,	Notched hammers.
m, n, o,	One-hand manos.
p,	Miniature (toy ?) troughed metate.

	Provenience			Catalogue Number
a,	Awatovi,	Room 39, floor	Pueblo V	35–126–10/5745
b,	"	Test 22, Room 10, S section, 175–195	"	37–111–10/11848
c,	"	Room 39, SE corner fill	"	39–97–10/19703
d,	"	Test 10, Room 3	Pueblo IV	36–131–10/8451
e,	"	Room 523, 200–250	"	37–111–10/11841
f,	"	Test 51, Room 15, 0–50	Pueblo V	39–97–10/19706
g,	"	Room 291, 0–100	Pueblo IV	36–131–10/8481
h,	Site 4A	Room 24, S alcove	Basket Maker III	39–97–10/20315
i,	Awatovi,	Room 291, 200–250	Pueblo III	36–131–10/8482
j,	"	Surface	Unassigned	36–131–10/8491
k,	"	Surface	"	35–126–10/5769
l,	"	Room 324, 100–150	Pueblo III	36–131–10/8484
m,	"	Room 285, 250–300	Pueblo IV	36–131–10/8398
n,	"	Room 501, 0–50	Pueblo V	37–111–10/11823
o,	"	Room 249	Pueblo IV	36–131–10/8365
p,	"	Room 207, lower	Pueblo III	36–131–10/8337



PESTLES, FULL-GROOVED LIPPED HAMMERS, NOTCHED HAMMERS, ONE-HAND MANOS, MINIATURE METATE.



Tools for Pounding, Pecking, and Rubbing.

Figure 19

TOOLS FOR POUNDING, PECKING, AND RUBBING

a–g,	Paint grinding stones. Top view of *a;* side view of *b, c, f, g;* view at angle of *d, e* from below. Considerable paint still adheres to the lower edges of *g.*
h,	Elongated pitted hammerstone.
i, j,	Cylindrical hammerstones.
k,	Rubbing and pounding stone.
l–o,	Discoidal hammerstones. Extremes of asymmetry and symmetry are represented by *l* and *o.*
p–v,	Pecking stones, showing progressive amounts of wear, finally resulting in *u,* which is approximately spherical. The largest and heaviest, *v,* was probably used in both hands.
w, b′,	Pounding and rubbing stones.
x–a′,	Pebble pounders.

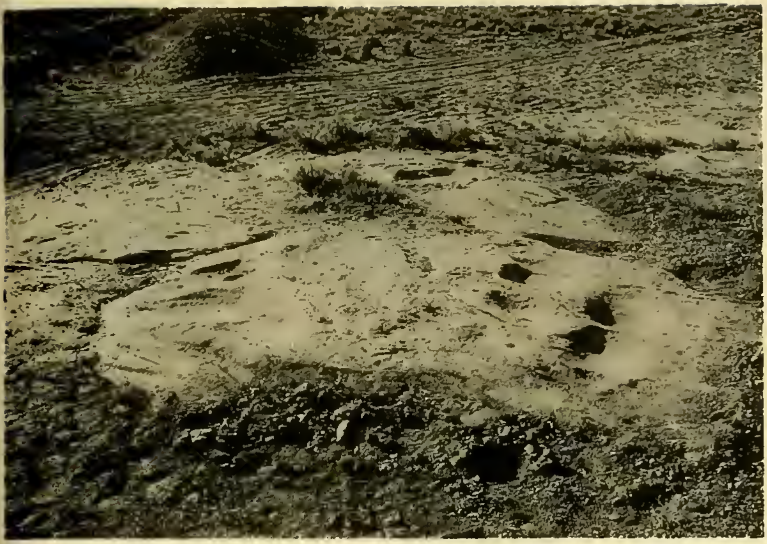
	Provenience			Catalogue Number
a,	Awatovi,	Test 51, Room 5, 0–50	Pueblo IV	39–97–10/19780
b,	"	Room 726, 50–100	Pueblo V	38–120–10/17636
c,	"	Room 59, floor	Pueblo IV	35–126–10/5776
d,	"	Test 51, 50–100	Pueblo IV or V	39–97–10/19779
e,	"	Room 400, 100–150	Pueblo V	37–111–10/11720
f,	"	Room 412, 50–100	"	37–111–10/11722
g,	"	Room 753, floor	"	38–120–10/17068
h,	"	Trench N of Room 714, Room 717, etc.	"	38–120–10/17112
i,	"	Room 420, 100–150	"	37–111–10/11660
j,	"	Test 36, Room 1, 0–floor	Pueblo IV or V	38–120–10/17486
k,	"	Room 229, fill	Pueblo IV	36–131–10/8496
l,	"	Room 34	Pueblo V	35–126–10/5774
m,	"	Test 23, Room 1, 0–50	Pueblo IV	37–111–10/11862
n,	"	Room 736, 0–50	Pueblo V	38–120–10/17501
o,	"	Room 416, 50–100	"	37–111–10/11659
p,	"	Test 36, Room 7, 100–157	Pueblo IV	38–120–10/17258
q,	Awatovi,	Room 238	Pueblo IV	36–131–10/8880
r,	Site 4A	Room 11	Basket Maker III	38–120–10/18070
s,	Awatovi,	Room 202	Pueblo III	36–131–10/8493
t,	"	Room 39, SE corner	Pueblo V	39–97–10/19751
u,	"	Room 330, fill between 2 floors	Pueblo III	37–111–10/11863
v,	"	Test 14, Room 6, 100–150	Pueblo IV	38–120–10/17209
w,	"	Room 703, 0–50	Pueblo V	38–120–10/17631
x,	"	Room 618, 100–150	"	37–111–10/11748
y,	Site 264,	Room 16, 75–100	Basket Maker III–Early Pueblo I	39–97–10/20477
z,	Awatovi,	Room 473, 300–350	Pueblo V	38–120–10/17608
a′,	"	Room 497, 0–50	"	38–120–10/17496
b′,	Pueblo V,	Surface	Pueblo V	39–97–10/20555

Figure 20

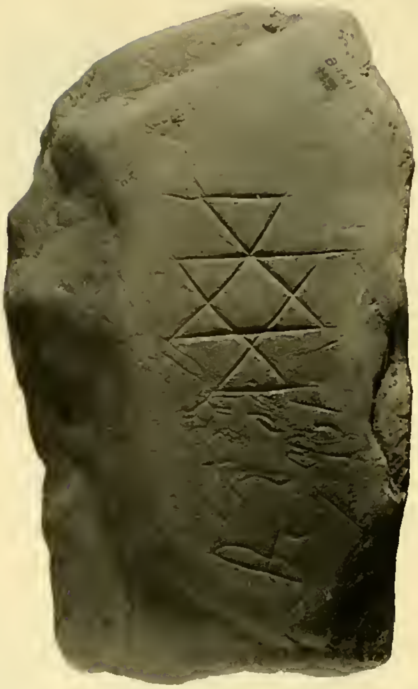
BED ROCK MORTARS, INCISED SLAB, AND SIMPLE GROOVED ABRADERS

a,	Bed rock mortars, perhaps for grinding or perhaps for shaping hand tools such as manos.
b,	Slab with incised decoration; length, 54 centimeters.
c–g,	Simple grooved abraders with single or multiple grooves. Maximum dimensions from 16 to 40 centimeters.

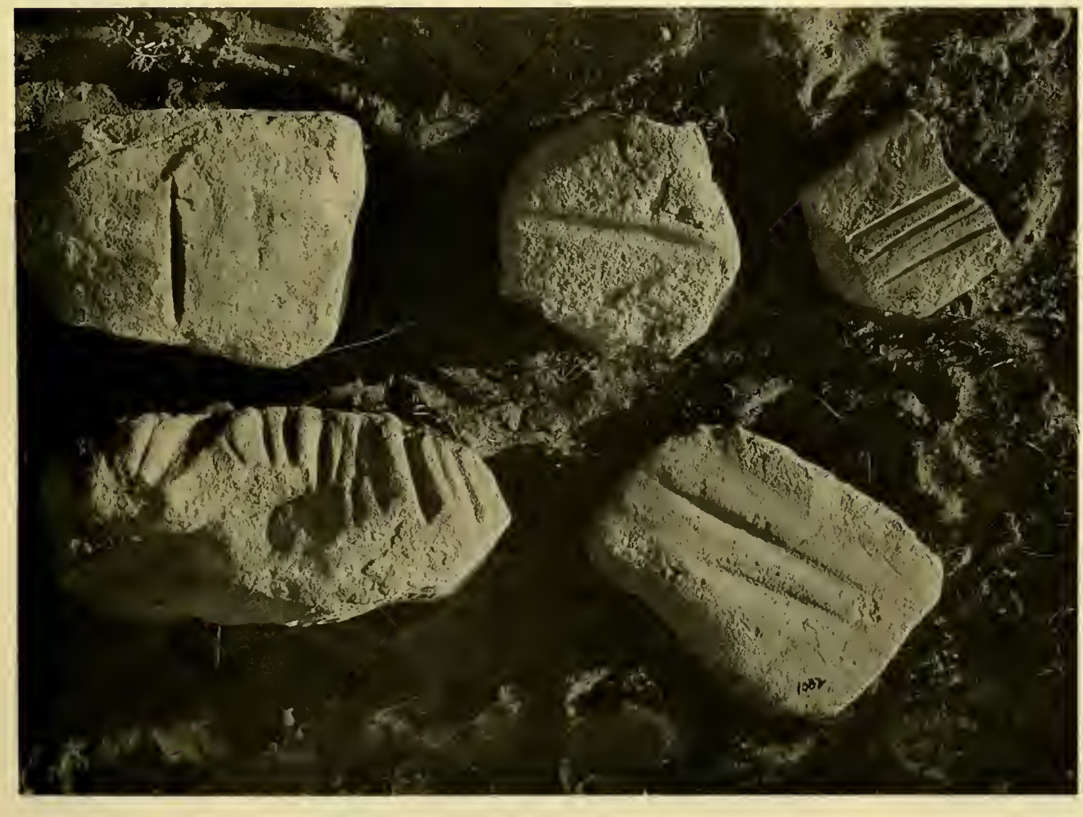
	Provenience			Catalogue Number
a,	Awatovi,	Bedrock, SE of Test 52	Unassigned	None
b,	"	Plug of door between Room 436 and Room 785	Pueblo V	38-120-10/17590
c,	"	Room 446, 50–100	"	None
d,	"	Test 14, Room 3	Pueblo IV	"
e,	"	Room 464, 100–150	Pueblo V	"
f,	"	Room 443	"	"
g,	"	Test 20, 200–250	Pueblo III	"



a

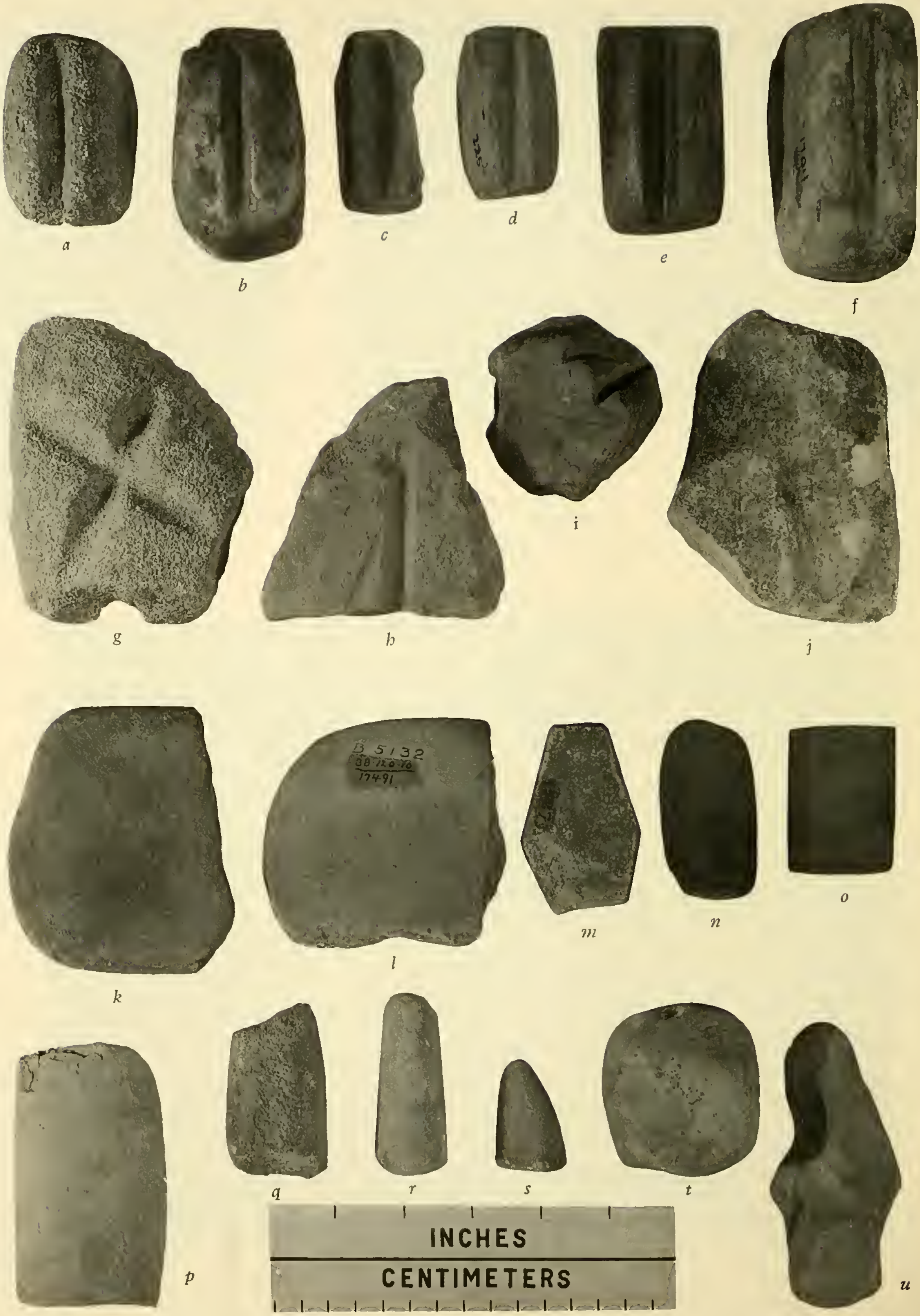


b



c – g

Bed Rock Mortars, Incised Slab, and Simple Grooved Abraders. (*b*, scale: 1/10; *c-g*, scale: 1/6.)



Shaftsmoothers, Simple Grooved Abraders and Flat Abraders.

FIGURE 21

SHAFTSMOOTHERS, SIMPLE GROOVED ABRADERS AND FLAT ABRADERS

a–f,	Loaf-shaped shaftsmoothers. See figure 11, *a–d,* for cross-sections.
g–j,	Simple grooved abraders.
k–o,	Tabular flat abraders.
p–r,	Bar-shaped flat abraders.
s–u,	Irregular flat abraders.

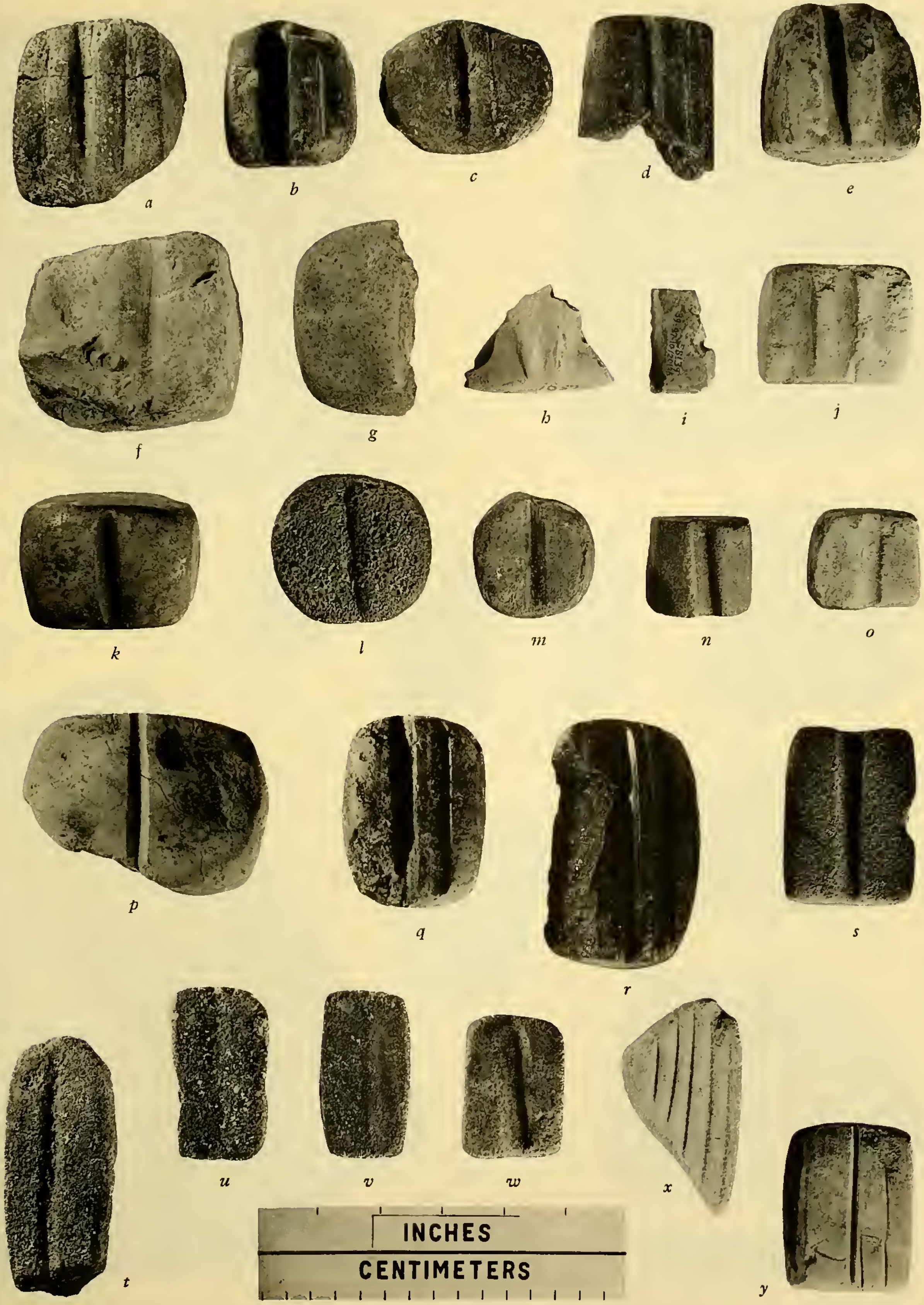
	PROVENIENCE			CATALOGUE NUMBER
a,	Awatovi,	Test 22, Room 3, 0–50	Pueblo V	37–111–10/11707
b,	"	Test 36, Room 1, 0–35	"	38–120–10/17575
c,	"	Test 22, Room 2, 50–100	"	37–111–10/11706
d,	"	Test 22, Room 2, 0–50	"	37–111–10/11705
e,	"	Test 57, Room 1, 50–100	Pueblo IV	39–97–10/19765
f,	"	Room 626, 50–100	Pueblo V	37–111–10/11670
g,	"	Room 15, under floor	Pueblo IV or V	35–126–10/5787
h,	"	Room 736, 50–100	Pueblo V	38–120–10/17547
i,	"	Room 223, lower fill	Pueblo IV	36–131–10/8588
j,	"	Test 19, Room 3, 50–100	"	38–120–10/17650
k,	"	Room 301, 100–150	Pueblo III	36–131–10/8411
l,	"	Test 49, Room 1, 100–150	Pueblo IV	38–120–10/17941
m,	"	Test 14, Room 2, 0–70	"	36–131–10/8554
n,	"	Room 477, 50–100	Pueblo V	38–120–10/17281
o,	"	Trench 1, S Plaza, 0–100	"	35–126–10/5845
p,	"	Room 768	"	38–120–10/17286
q,	"	Room 253, AA 0–60	Pueblo III	36–131–10/8593
r,	"	Room 277, 300–350	Pueblo IV	36–131–10/8447
s,	"	Test 14, Room 4, 50–100	"	37–111–10/11674
t,	"	Test 14, Room 6, 100–150	"	38–120–10/17212
u,	Site 108	Room 2, 75–100	Pueblo II–III	39–97–10/20388

FIGURE 22

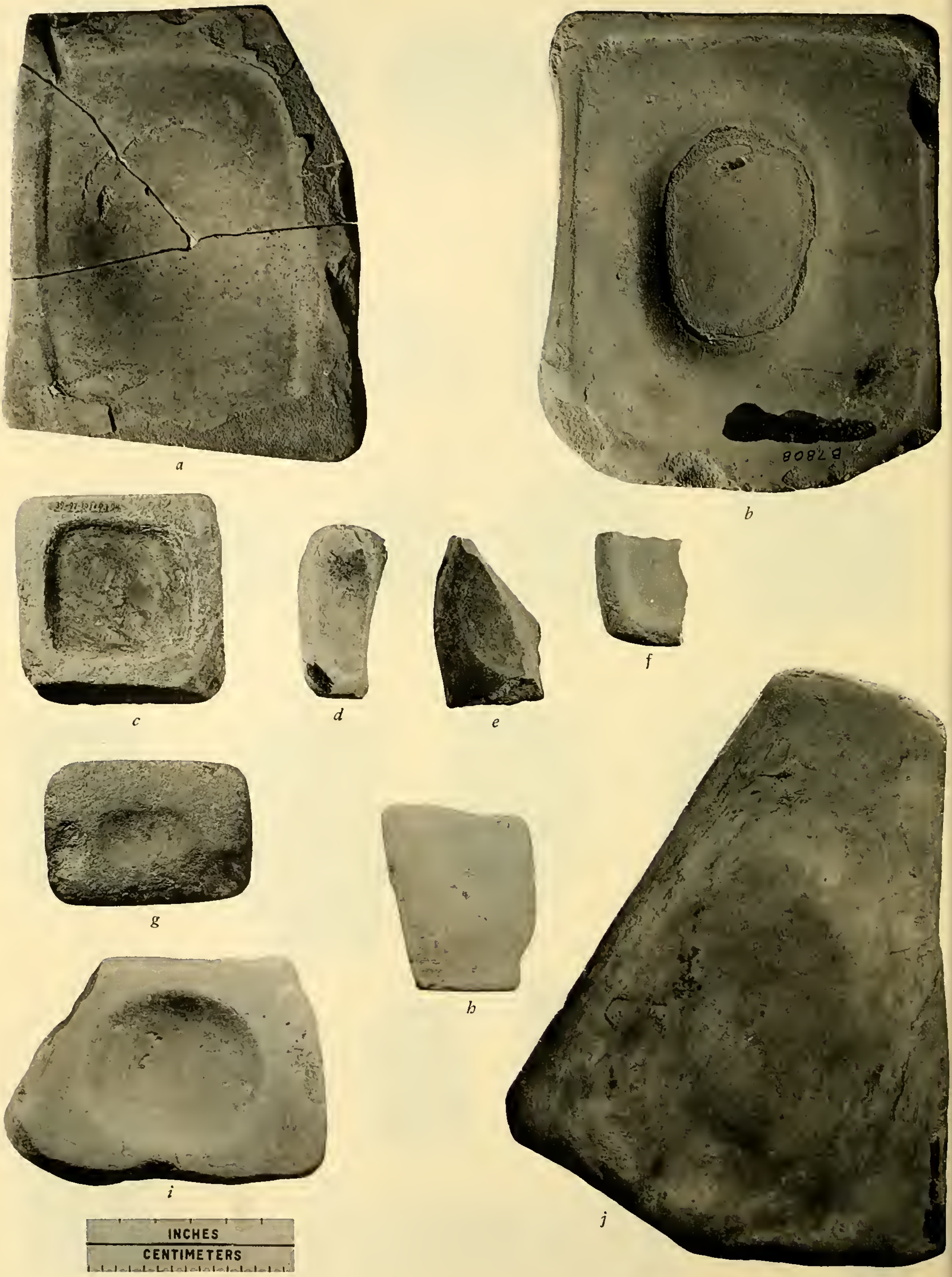
SHAFTSMOOTHERS

a–e,	Ridged shaftsmoothers, with ridge parallel to groove. See also figure 11 *e, f, g*.
f–h,	Ridged shaftsmoothers, with T-shaped ridge. Fired clay, instead of stone, is used for *h*.
i,	Fragment of shaftsmoother with perforation.
j–p,	Transversely grooved shaftsmoothers.
q–r,	Double-grooved elongated shaftsmoothers.
s–w,	Elongated shaftsmoothers.
x,	Fragment of multiple-grooved shaftsmoother.
y,	Unfinished (?) shaftsmoother. Groove has V-shaped cross-section, possibly used to sharpen bone needles or awls.

	Provenience			Catalogue Number
a,	Awatovi,	Room 802, 0–44	Pueblo V	38–120–10/17551
b,	"	Room 626, 0–125, E end	"	37–111–10/11699
c,	"	Test 64, 0–100	Pueblo IV	39–97–10/19769
d,	"	Test 19, Room 3, 250–floor	"	38–120–10/17562
e,	"	Room 627, 50–100	Pueblo V	37–111–10/11700
f,	"	Test 28, Room 1, 0–45	"	38–120–10/17565
g,	"	Test 64, 0–100	Pueblo IV	39–97–10/19768
h,	"	Room 306, 0–85	"	36–131–10/8599A
i,	Pink Arrow,	Room 6, 0–75	Pueblo III–IV	39–97–10/20316
j,	Awatovi,	Surface	Unassigned	39–97–10/20558
k,	"	Test 7, Room 1	Pueblo IV	36–131–10/8602
l,	"	Room 224, top	"	36–131–10/8569
m,	"	Room 224, lower	"	36–131–10/8590
n,	"	Test 64, 0–100	"	39–97–10/19770
o,	"	Room 251	"	36–131–10/8592
p,	"	Room 262, 225–250	Pueblo III	36–131–10/8594
q,	"	Room 419, 50–100	Pueblo V	37–111–10/11679
r,	"	Surface	Unassigned	35–126–10/5786
s,	Pink Arrow,	Surface	Pueblo III–IV	39–97–10/20141
t,	Kawaika-a,	Test 4, Room 5, 100–150	Pueblo III–IV	39–97–10/20272
u,	"	"	"	39–97–10/20273A
v,	"	"	"	39–97–10/20273
w,	Awatovi,	Room 73, N, 0–50	Pueblo IV	35–126–10/5782
x,	Pink Arrow,	Surface	Pueblo III–IV	39–97–10/20140
y,	Awatovi,	Test 41, Room 1, 0–50	Pueblo V	38–120–10/17580



Shaftsmoothers.



Raised-Border Palettes and Grinding Slabs.

Figure 23

RAISED-BORDER PALETTES AND GRINDING SLABS

a–f, Raised-border palettes. There is a secondary depression worn in the mixing surface of *a* and *b*, but not in the smaller ones, *c–f*.

g–j, Grinding slabs. Blue-green paint stains the surface of *j*.

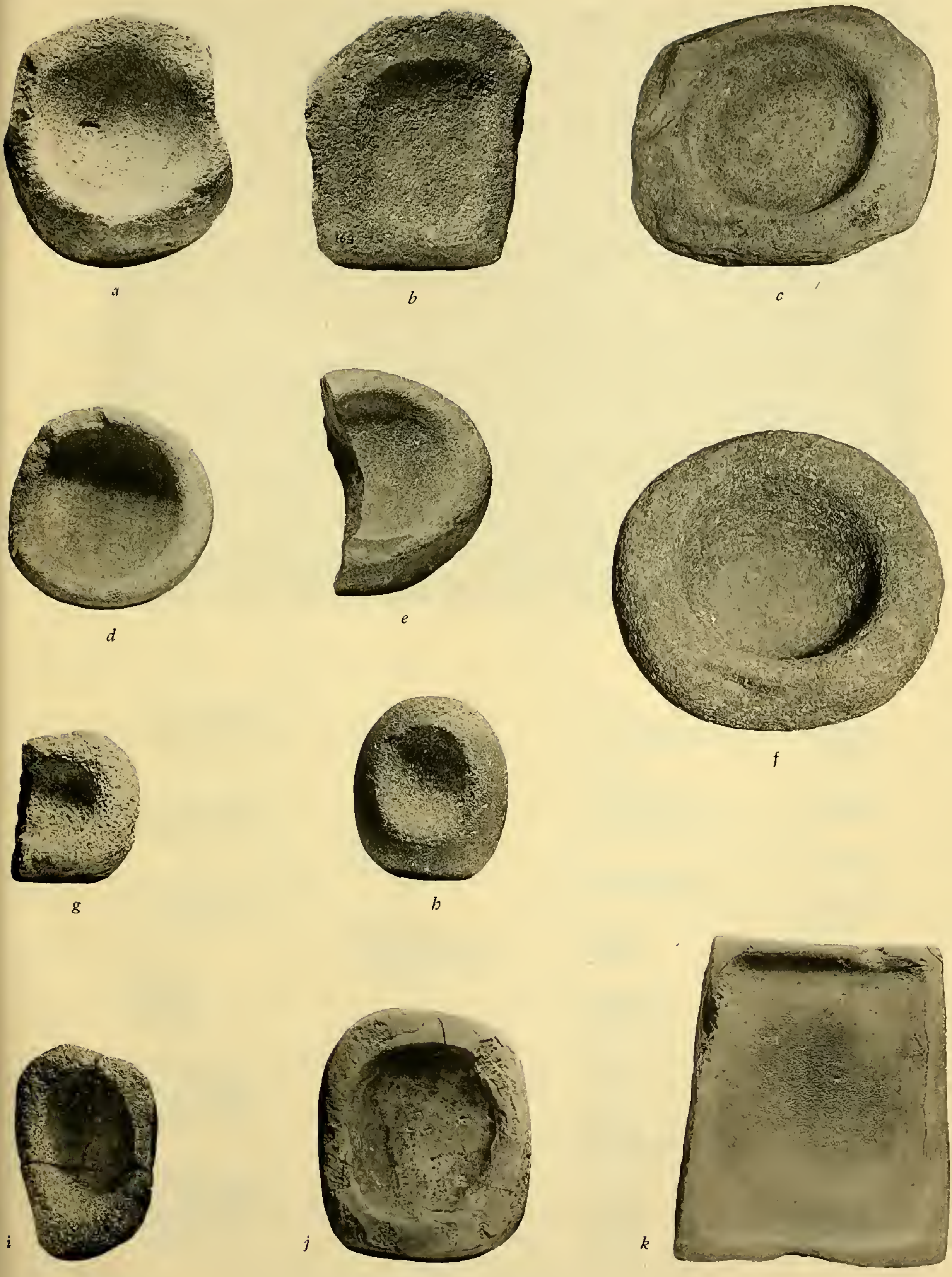
	Provenience			Catalogue Number
a,	Awatovi,	Room 718, 100–150	Pueblo V	38–120–10/17062
b,	"	Surface	Unassigned	39–97–10/19796
c,	"	Test 51, Room 11, 90–110	Pueblo IV	39–97–10/19794
d,	"	Test 41, Room 1, 0–50	Pueblo V	38–120–10/17338
e,	"	Square 500J, 0–50	"	37–111–10/11869
f,	"	Room 768	"	38–120–10/17059
g,	"	Room 701, 100–150	"	38–120–10/17061
h,	Pink Arrow,	Room 3, 100–150	Pueblo III–IV	39–97–10/20168
i,	Awatovi,	Room 719, 50–100	Pueblo V	38–120–10/17331
j,	"	Test 33, Room 4, floor	Pueblo IV	38–120–10/17065

Figure 24

MORTARS AND RAISED-BORDER PALETTES

a–c,	Roughly-shaped mortars.
d–f,	Bowl-shaped mortars, of common shapes.
g–i,	Bowl-shaped mortars, atypical: *g,* apparently subrectangular; *h,* probably unfinished; *i,* ovoid, crudely shaped.
j–k,	Raised-border palettes.

	Provenience			Catalogue Number
a,	Awatovi,	Room 717, 50–100	Pueblo V	38–120–10/17330
b,	"	Room 261, beneath top floor	Pueblo IV	36–131–10/8338
c,	"	Test 38, Room 2, 100–160	Pueblo V	38–120–10/17337
d,	"	Test 9, 0–50	Pueblo IV	36–131–10/8345
e,	"	Room 37	Pueblo V	35–126–10/5737
f,	"	Room 528, 50–100	Pueblo IV	39–97–10/19701
g,	"	Room 203	Pueblo III	36–131–10/8339
h,	"	Room 84, 0–100	Pueblo V	35–126–10/5741
i,	"	Room 231	Pueblo III or IV	36–131–10/8346
j,	"	Room 737	Pueblo V	38–120–10/17332
k,	"	Surface	Unassigned	38–120–10/17066



Mortars and Raised-Border Palettes. (Scale: 1/5.)

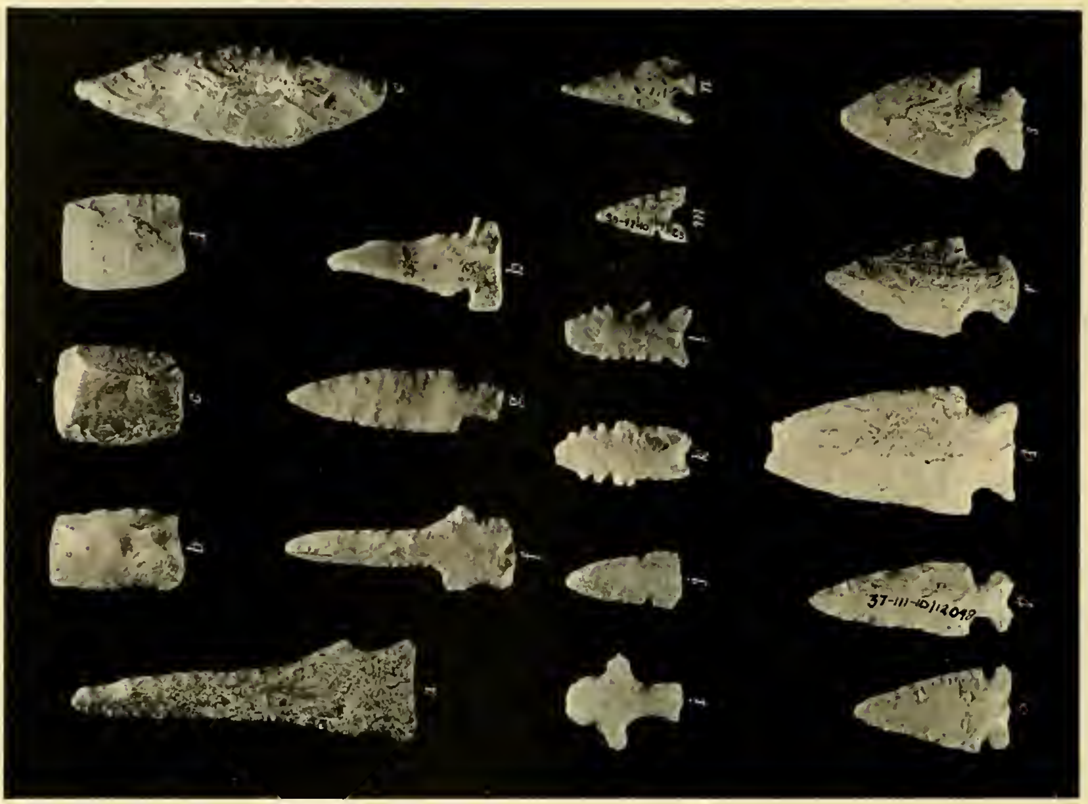


Fig. 26. Chipped Drills, Points and Scrapers, and Gun Flints (?). (Scale: 1/2.)

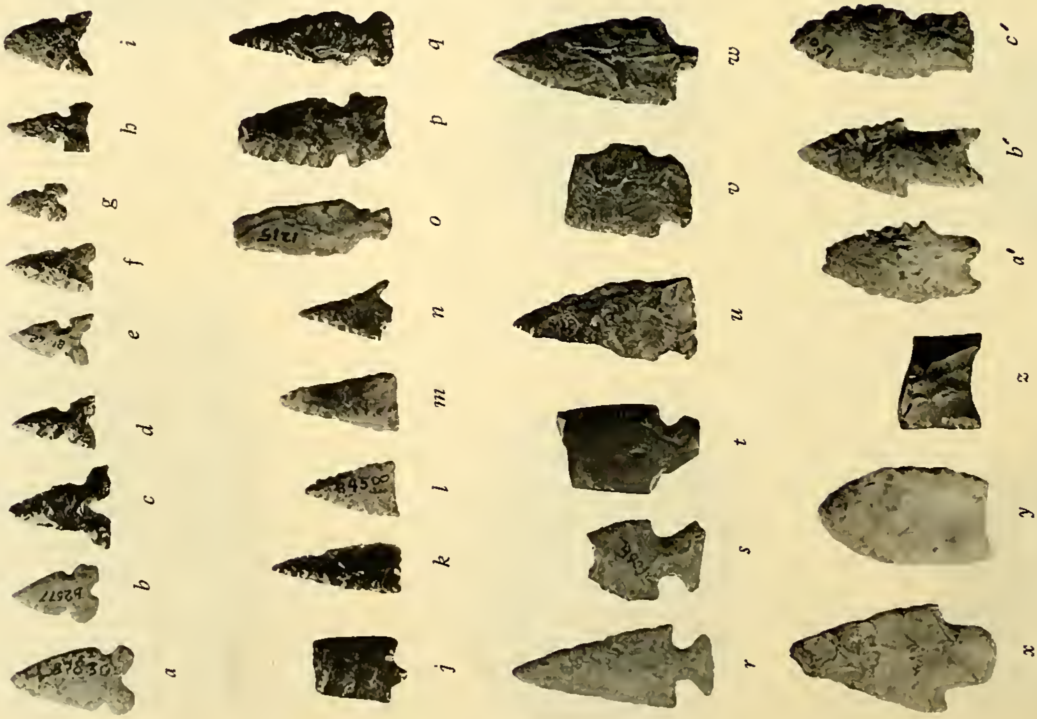


Fig. 25. Chipped Points and Blades. (Scale: 2/3.)

Figure 25

CHIPPED POINTS AND BLADES

a–g,	Side notched points, based notched, stem wider than shoulder.
h,	Side notched point, straight base, stem wider than shoulder.
i,	Side notched point, concave base, stem wider than shoulder.
j,	Basal tit point.
k–m,	Stemless small blades, straight base.
n,	Diagonal notched point, slender, barbed.
o,	Side notched point, narrow base, stem narrower than shoulder.
p, *t–v*,	Side notched points, wide base, stem narrower than shoulder.
q,	Side notched point, straight base, stem wider than shoulder.
r–s,	Diagonal notched points, broad, shouldered.
w–x,	Diagonal notched points, tapered stem.
y–z,	Fluted points, Folsom-like.
a′–c′,	Serrate points.

	Provenience			Catalogue Number
a,	Awatovi,	Surface	Unassigned	39–97–10/19531
b,	”	Room 721, 0–50	Pueblo V	38–120–10/16410
c,	”	Surface	Unassigned	38–120–10/16471
d,	”	Surface	”	37–111–10/12083
e,	”	Surface	”	38–120–10/16439
f,	”	Surface	”	39–97–10/19513
g,	”	Surface	”	39–97–10/19513A
h,	”	Surface	”	35–126–10/5804
i,	”	Surface	”	39–97–10/19497
j,	”	Surface	”	38–120–10/16450
k,	”	Room 218, 100–150	Pueblo IV	36–131–10/8769
l,	Site 4A,	Room 5E, 10	Pueblo I	38–120–10/18051
m,	Awatovi,	Surface	Unassigned	38–120–10/16717
n,	Site 264,	Room 16 0–60, S recess	Basket Maker III-early Pueblo I	39–97–10/20457
o,	Awatovi,	Surface	Unassigned	37–111–10/12076
p,	Site 4A,	Room 5E, 10	Pueblo I	38–120–10/18052
q,	Awatovi,	Room 434, Burial 89	Pueblo V	37–111–10/12037
r,	”	Surface	Unassigned	37–111–10/12038
s,	Site 4A,	S edge, general digging	Unassigned	39–97–10/20310
t,	Awatovi,	Test 46, Room 3, 50–100	Pueblo V	39–97–10/19477
u,	Site 264,	Room 16, 100–150	Basket Maker III-early Pueblo I	39–97–10/20461
v,	”	Room 24, W end	”	39–97–10/20312
w,	Awatovi,	Room 616, 80–125	Pueblo V	39–97–10/19517
x,	”	Test 51, 50–100	Unassigned	39–97–10/19479
y,	”	Trench 1, S Plaza, 0–100	Pueblo V	35–126–10/5827
z,	”	Surface	Unassigned	38–120–10/16858
a′,	”	Room 753, 0–50	Pueblo V	38–120–10/16416
b′,	”	Surface	Unassigned	35–126–10/5801
c′,	”	Room 422, 0–50	Pueblo V	37–111–10/12035

Figure 26

CHIPPED DRILLS, POINTS AND SCRAPERS, AND GUN FLINTS (?)

a,	Drill, side notched.
b–d,	Gun flints (?), perhaps locally made under Spanish direction.
e,	Drill, shaft widened at middle.
f,	Drill, side notched.
g,	Side notched point, narrow base, stem narrower than shoulder.
h,	Drill, side notched.
i,	Scraper, concave edged.
j,	Side notched point, straight base, stem wider than shoulder.
k–l,	Serrate points.
m,	Side notched point, base notched, stem wider than shoulder.
n,	Diagonal notched point, slender, barbed.
o,	Side notched point, straight base, stem wider than shoulder.
p,	Side notched point, wide base, stem narrower than shoulder.
q–s,	Diagonal notched points, broad, shouldered or barbed.

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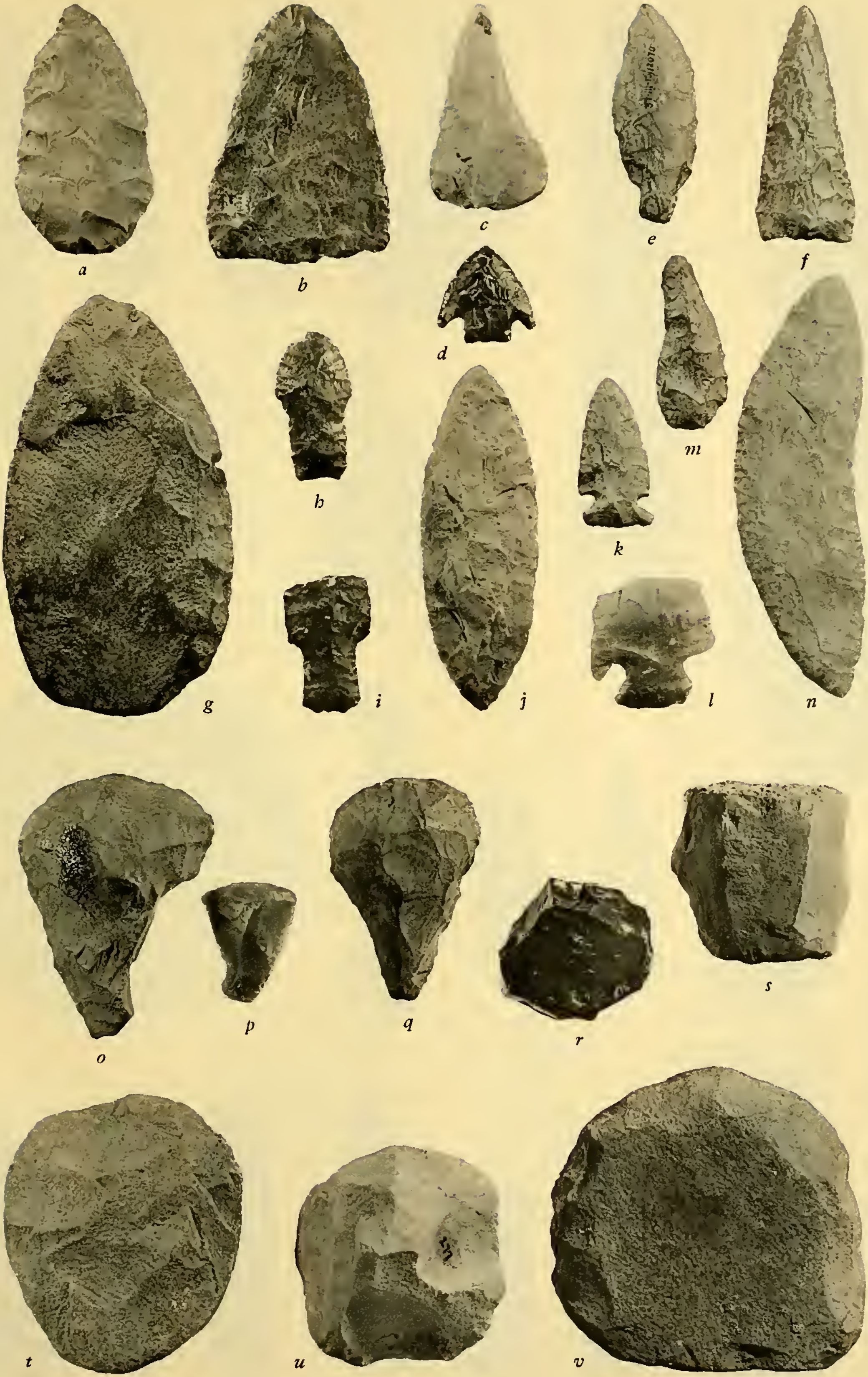
	Provenience			Catalogue Number
a,	Site 105,	Room 8, floor	Pueblo II–III	39–97–10/20359
b,	Awatovi,	Surface	Unassigned	36–131–10/8765
c,	"	Room 768	Pueblo V	38–120–10/16586
d,	"	Surface	Unassigned	38–120–10/16470
e,	"	Room 271, above sand	Pueblo IV	36–131–10/8873
f,	"	Trench 1, S Plaza, 60	Pueblo V	36–126–10/5811
g,	"	Room 529, 50–100	Pueblo V	39–97–10/19471
h,	"	Surface	Unassigned	37–111–10/12072
i,	"	Room 521	Pueblo IV	37–111–10/12051
j,	"	Room 625, 0–50	Pueblo V	37–111–10/12063
k,	"	Surface	Unassigned	39–97–10/19506
l,	Kawaika-a,	Surface	Pueblo III–IV	39–97–10/20257
m,	Awatovi,	Surface	Unassigned	39–97–10/19523
n,	Site 4A,	Room 5, 35	Pueblo I	38–120–10/18050
o,	Awatovi,	Room 207, lower	Pueblo III	36–131–10/8767
p,	"	Room 465, Burial 97	Pueblo V	37–111–10/12048
q,	"	Room 204	Pueblo III	36–131–10/8766
r,	"	Room 443, 50–100	Pueblo V	37–111–10/12040
s,	Site 6,	Surface	Basket Maker III-Pueblo I	35–126–10/6018

Figure 27

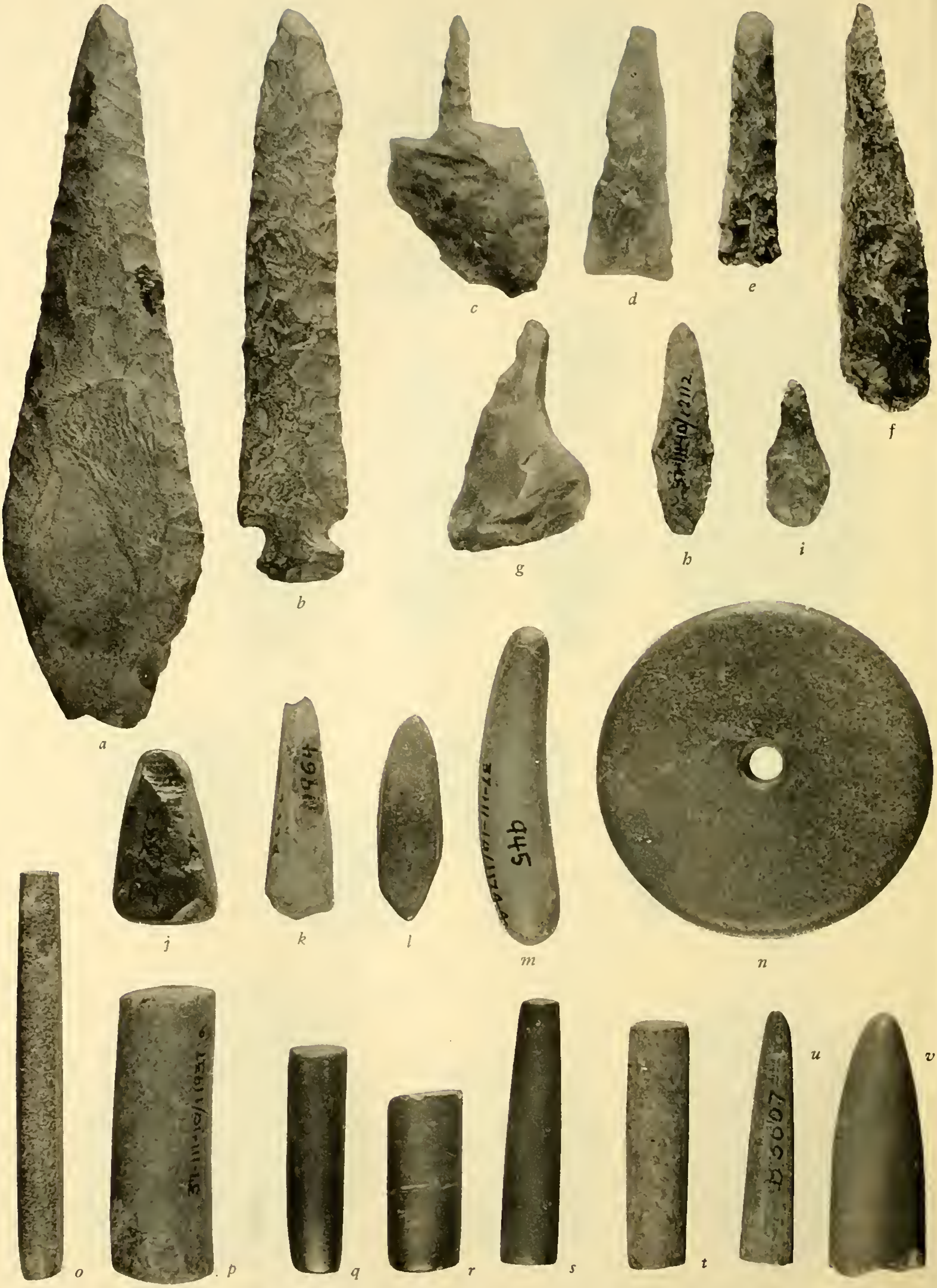
CHIPPED POINTS AND BLADES, SCRAPERS, CORES AND "CHOPPERS"

a,	Stemless blade, round base.
b,	Stemless large blade, straight base.
c,	Asymmetric stemless blade.
d,	Diagonal notched point, broad, barbed.
e,	Stemmed lenticular point.
f,	Stemless large blade, straight base.
g,	Stemless blade, round base.
h–i,	Broad straight-stemmed point.
j,	Stemless blade, pointed base.
k,	Side notched point, wide base, stem narrower than shoulder.
l,	Diagonal notched point, broad, barbed.
m–n,	Asymmetric stemmed blades.
o–q,	Snub-nosed scrapers.
r–s,	Cores, obsidian and chert.
t–v,	"Choppers."

	Provenience			Catalogue Number
a,	Awatovi	Room 788, near W wall, 100 centimeters below roof	Pueblo V	38–120–10/16924
b,	"	Room 212, 0–50	Pueblo III	36–131–10/8801
c,	"	Room 85	Pueblo IV	35–126–10/5823
d,	Site 264,	Surface	Basket Maker III-early Pueblo I	39–97–10/20459
e,	Awatovi,	Test 22, Room 7, 50–100	Pueblo V	37–111–10/12070
f,	"	Room 803, 0–50	Pueblo V	38–120–10/16905
g,	"	Room 308, 50–100	Pueblo IV	36–131–10/9297
h,	"	Test 10, Room 7, floor	Pueblo IV	36–131–10/8776
i,	"	Surface	Unassigned	39–97–10/19507
j,	"	Surface	Unassigned	36–131–10/8865
k,	"	Room 768	Pueblo V	38–120–10/16421
l,	"	Room 310, AA 100–150	Pueblo III	36–131–10/8775
m,	"	Test 26, Room 1, 0–50	Pueblo IV	37–111–10/12106
n,	"	Room 277, AA 250–300	Pueblo III	36–131–10/8845
o,	"	Room 272, 150–200	Pueblo IV	36–131–10/8750
p,	Kokopnyama,	Surface	Pueblo III–IV	35–126–10/6069
q,	Awatovi,	Room 307, 0–50	Pueblo IV	36–131–10/8760
r,	Site 231,	Room 6	Pueblo III	39–97–10/20435
s,	Awatovi,	Test 14, Room 5, 0–50	Pueblo IV	38–120–10/16894
t,	"	Room 253	"	36–131–10/8877
u,	"	Room 215	"	36–131–10/8876
v,	"	Test 57, Room 1, 50–100	"	39–97–10/19580



Chipped Points and Blades, Scrapers, Cores and "Choppers." (Scale: 1/2.)



Chipped Drills, Small Ground Ornaments (?), Spindle Whorl (?), Slender Polished Cylinders, and Small Tapered Stones. (Actual size.)

Figure 28

CHIPPED DRILLS, SMALL GROUND ORNAMENTS (?), SPINDLE WHORL (?), SLENDER POLISHED CYLINDERS, AND SMALL TAPERED STONES

a,	Drill, shaft widened at middle.
b,	Drill, side notched.
c,	Drill, base expanded.
d, f,	Drill, triangular.
e,	Drill, plain shafted.
g,	Drill, flake.
h,	Drill, shaft widened at middle.
i,	Drill, base expanded.
j–l,	Unperforated ornaments (?) *j,* of ground obsidian; *k,* 4-sided object of fine-grained sandstone; *l,* object of concretionary limestone.
m,	Small tapered stone, of unknown use.
n,	Spindle whorl (?).
o–t,	Slender polished cylinders (nose plugs?).
u–v	Small tapered stone, of unknown use.

	Provenience			Catalogue Number
a,	Awatovi,	Surface	Unassigned	38–120–10/16926
b,	"	Room 439, 50–100	Pueblo V	37–111–10/12039
c,	"	Room 28, 0–100	"	35–126–10/5810
d,	"	Surface	Unassigned	38–120–10/16720
e,	"	Room 767, 75–125	Pueblo V	38–120–10/16417
f,	"	Room 308, 150–200	Pueblo IV	36–131–10/8791
g,	"	Room 251	"	36–131–10/8784
h,	"	Room 466, 50–100	Pueblo V	37–111–10/12112
i,	"	Room 309, 0–75	Pueblo III	36–131–10/8792
j,	"	Room 493, 0–75	Pueblo V	38–120–10/17627
k,	"	Room 301, 0–100	Pueblo IV	36–131–10/8656
l,	Site 231,	Trench A	Pueblo III	39–97–10/20443
m,	Awatovi,	Square 500F, 50–100	Pueblo IV	37–111–10/11744
n,	Kokopnyama,	Surface	Pueblo III–IV	38–120–10/18159
o,	Awatovi,	Room 620, 0–50	Pueblo V	37–111–10/11928
p,	"	Test 24, Square E, Burial 15	Unassigned	37–111–10/11937
q,	"	Room 301, 0–100	Pueblo IV	36–131–10/8656A
r,	"	Room 468, floor	Pueblo V	37–111–10/11920
s,	"	Room 207, lower	Pueblo III	36–131–10/8669A
t,	"	Test 14, Room 3, 100–150	Pueblo IV	37–111–10/11931
u,	"	Room 768	Pueblo V	38–120–10/17667
v,	"	Room 444, AAA 0–50	"	37–111–10/11886

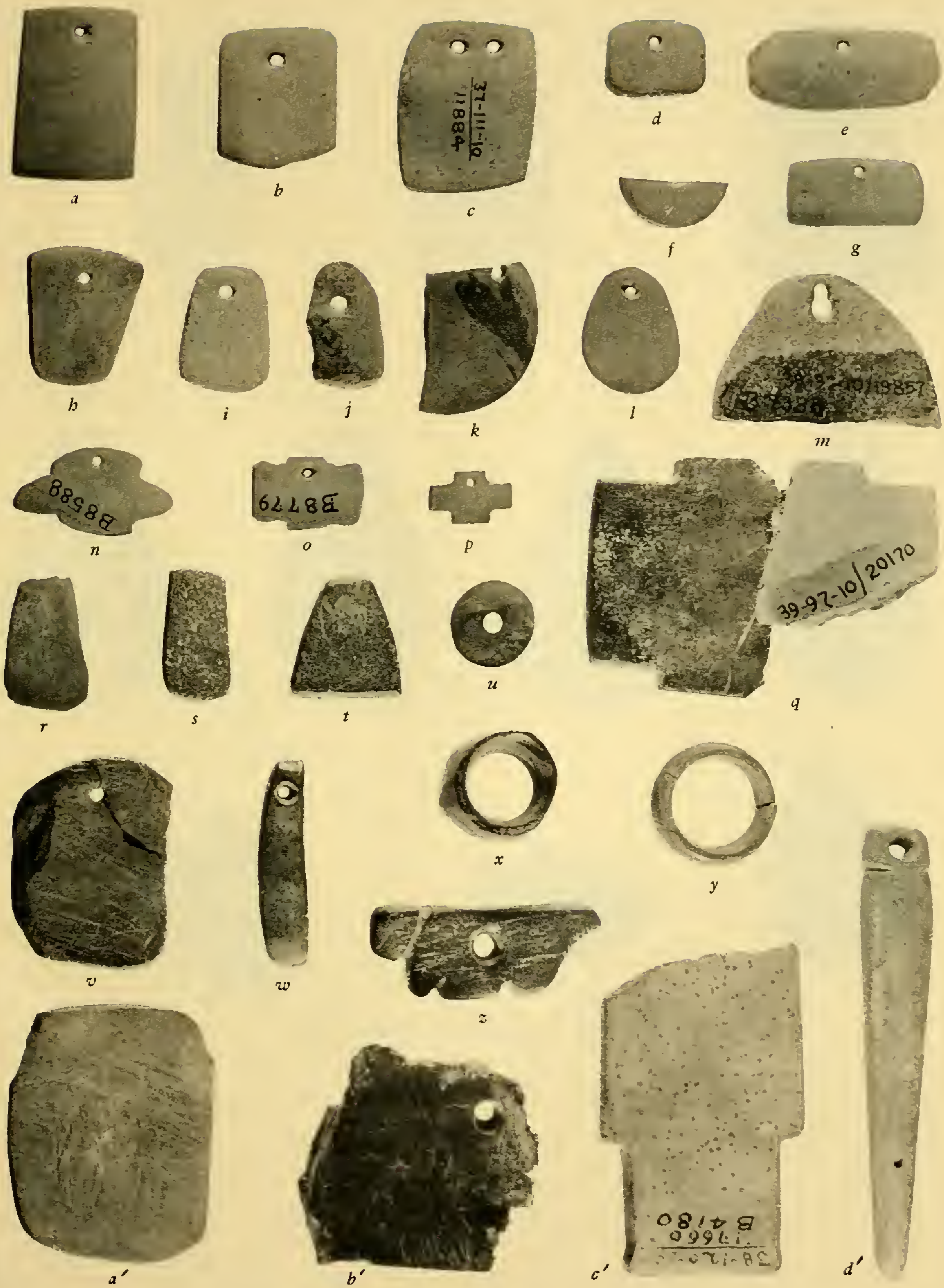
FIGURE 29

PENDANTS, BEADS, RINGS, AND UNPERFORATED OBJECTS, POSSIBLY ORNAMENTS

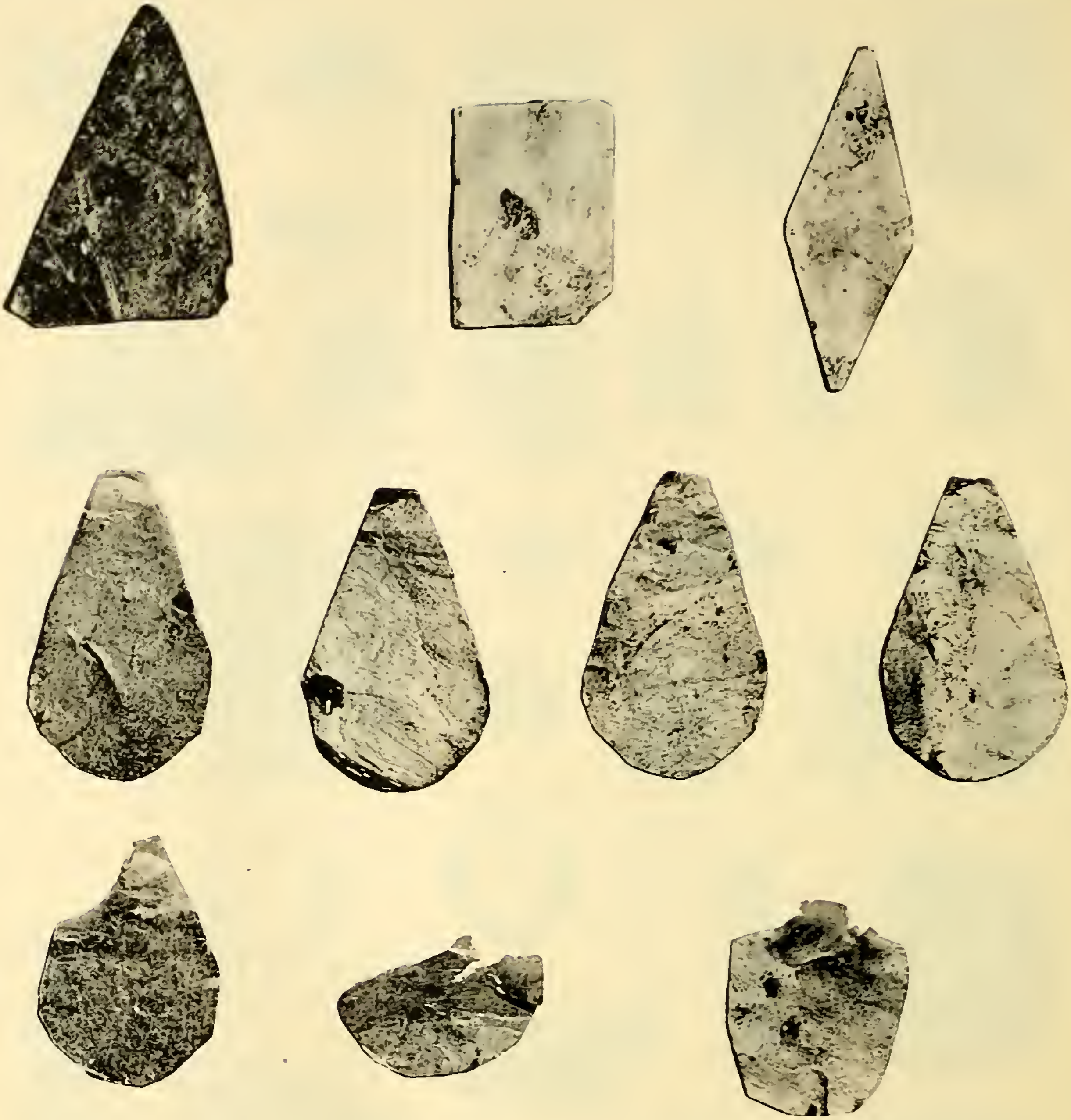
a–e, g,	Rectangular or subrectangular pendants.
f,	Fragment of round pendant.
h–j,	Trapezoidal pendants.
k,	Fragment of round pendant.
l,	Ovoid pendant.
m,	Fragment of oval or ovoid pendant. Note wear by suspension cord.
n–q,	Cruciform pendants.
r–t,	Unperforated ornaments (unfinished ?).
u,	Bead (?).
v,	Crude subrectangular pendant.
w,	Pendant, highly polished.
x–y,	Finger rings (?).
z,	Zoomorphic pendant.
a′,	Unperforated ornament (unfinished ?).
b′,	Irregular fragment of polished lignite (pendant ?).
c′,	Shouldered object of spotted slate (ornament ?).
d′,	Slender conical pendant.

Note: Red argillite was used for *a–h, j–l, n–p, r–u, y–a′*.

	Provenience			Catalogue Number
a,	Awatovi,	Room 31, floor	Pueblo V	35–126–10/5831
b,	"	Surface	Unassigned	36–131–10/8674
c,	"	Room 400, floor	Pueblo V	37–111–10/11884
d,	Site 4,	W unit, Kiva I	Pueblo II	35–126–10/6010
e,	Awatovi,	Room 223	Pueblo IV	36–131–10/8673
f,	Chakpahu,	Surface	Pueblo III–IV	39–97–10/20553
g,	Awatovi,	Room 202	Pueblo III	39–97–10/19856
h,	"	Room 213	Pueblo IV	36–131–10/8672
i,	"	Surface	Unassigned	36–131–10/8676
j,	"	Room 616, 0–50	Pueblo V	37–111–10/11896
k,	"	Room 201	Pueblo III	36–131–10/8670
l,	"	Test 34, 0–50	Pueblo IV	38–120–10/17348
m,	"	Test 51, Room 8, 50–100	"	39–97–10/19857
n,	Site 108,	Room 2, Burial 1	Pueblo II–III	39–97–10/20392
o,	Pink Arrow,	Room 32, 200–250	Pueblo III–IV	39–97–10/20172
p,	Kokopnyama,	Surface	"	35–126–10/6065
q,	Pink Arrow,	Room 32, 200–250	"	39–97–10/20170
r,	Kokopnyama,	Surface	"	35–126–10/6066
s,	Awatovi,	Surface	Unassigned	35–126–10/5847
t,	"	Surface	"	36–131–10/9312
u,	"	Room 248	Pueblo IV	36–131–10/8678
v,	"	Room 30, 100–200	Pueblo V	35–126–10/5830
w,	"	Room 480, 60–100	"	38–120–10/17343
x,	Site 111,	Room 4, 50–100	Pueblo II	39–97–10/20422
y,	Awatovi,	Test 60, Room 1, 0–50	Pueblo IV	39–97–10/19848
z,	"	Room 719, 50–100	Pueblo V	38–120–10/17345
a′,	"	Room 272, 0–100	Pueblo IV	36–131–10/8675
b′,	"	Test 48, Room 1, 175–225	Pueblo V	38–120–10/17684
c′,	"	Room 444, under floor	"	38–120–10/17660
d′,	Pink Arrow,	Room 6, 0–75	Pueblo III–IV	39–97–10/20175



PENDANTS, BEADS, RINGS, AND UNPERFORATED OBJECTS, POSSIBLY ORNAMENTS. (Actual size.)



Mica Objects. (Slightly larger than actual size.)

FIGURE 30

MICA OBJECTS

Mica objects, found on the floor of the main church at Awatovi, in front of the steps up to the altar. Probably used as decoration on ecclesiastical equipment.

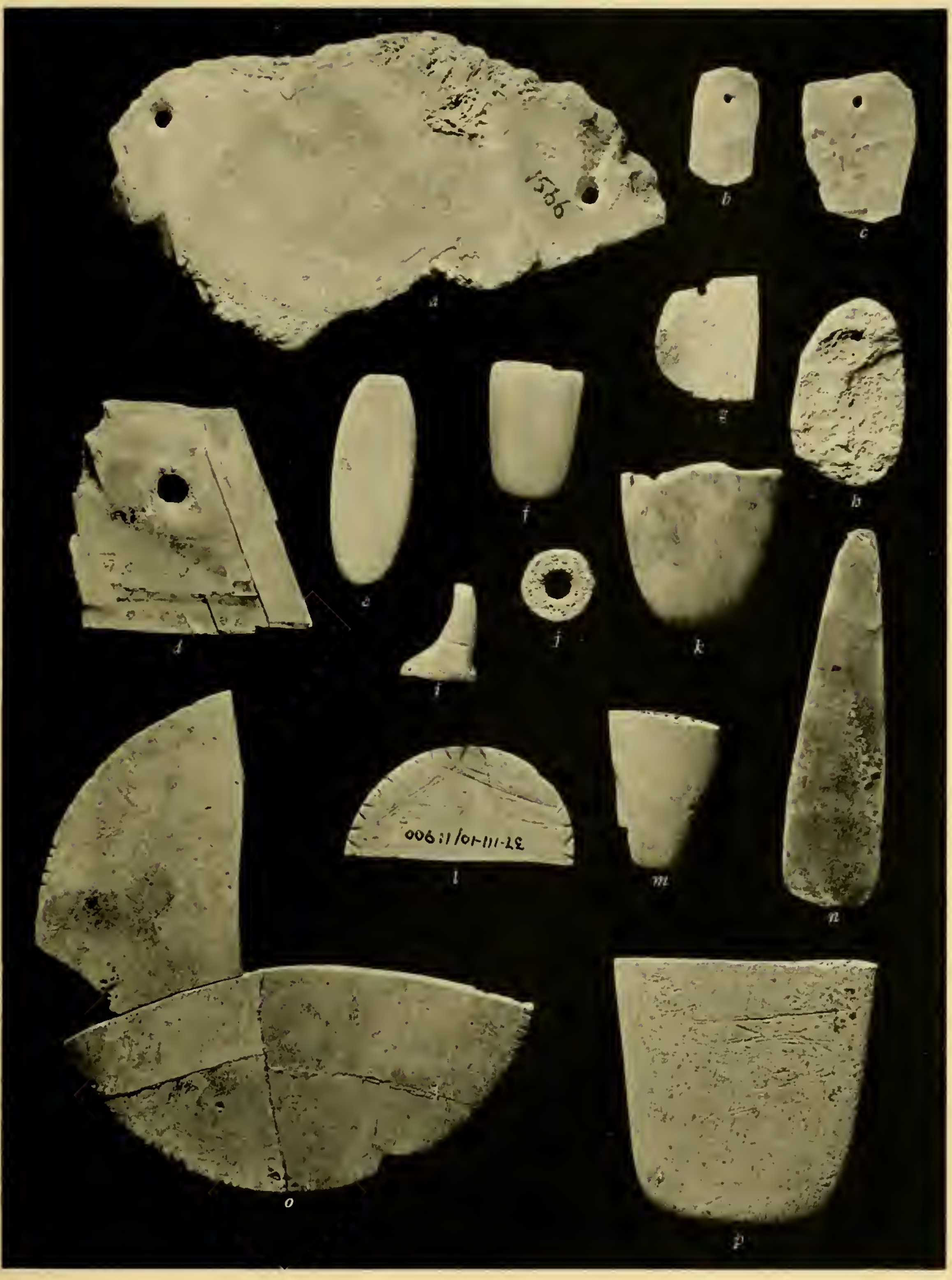
Provenience	Catalogue Number
Awatovi, Room 444, floor	37-111-10/12843A

FIGURE 31

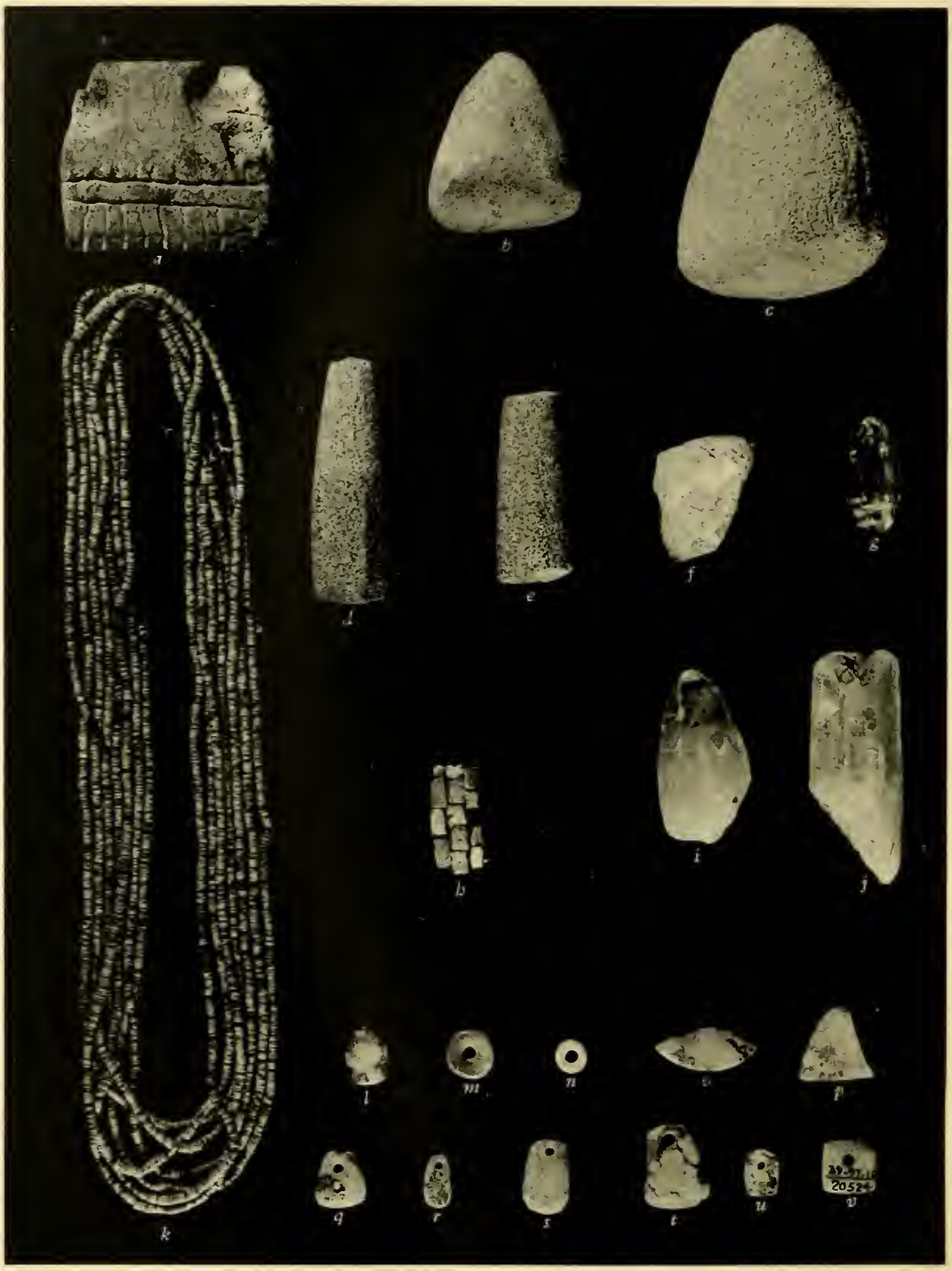
PENDANTS, BEADS, AND UNPERFORATED OBJECTS, POSSIBLY ORNAMENTS

a,	Crude pendant with incised decoration.
b–c,	Crude rectangular and trapezoidal pendants.
d,	Irregular piece of selenite, showing natural cleavage. Perforated for suspension.
e,	Unperforated ornament (?).
f,	Spatulate object, use unknown.
g,	Fragment of oval pendant.
h,	Ovoid pendant, unfinished.
i,	Hook shaped object of gypsum, use unknown.
j,	Bead, made of fossil crinoid stem.
k,	Spatulate object, use unknown.
l,	Fragment of disk with incised edges.
m,	Shouldered object (ornament ?).
n,	Unfinished pendant (?).
o,	Fragment of disk with notched edges.
p,	Spatulate object, use unknown.

	PROVENIENCE			CATALOGUE NUMBER
a,	Awatovi,	Room 623, 0–50	Pueblo V	37-111-10/11899
b,	"	Test 14, Room 4, 0–50	Pueblo IV	38-120-10/17347
c,	"	Test 14, Room 4, 0–50	"	38-120-10/17346
d,	"	Room 727, 75–125	Pueblo V	38-120-10/17746
e,	"	Room 269, top	Pueblo IV	36-131-10/8667
f,	"	Surface	Unassigned	36-131-10/8682
g,	Site 14,	Surface	Pueblo II	35-126-10/6027
h,	"	Surface	"	35-126-10/6026
i,	Site 111,	Room 4, 100–150	"	39-97-10/20411
j,	Awatovi,	Surface	Unassigned	36-131-10/8680
k,	"	Test 46, Room 3, 50–100	Pueblo V	39-97-10/19461
l,	"	Room 626, 100–150	Pueblo IV	37-111-10/11900
m,	Site 263,	Trench 3	Pueblo I-II	39-97-10/20454
n,	Awatovi,	Square 600B, 50–100	Pueblo IV	37-111-10/11901
o,	"	Room 251, "alley"	"	36-131-10/8677
p,	Site 264,	Room 16, on bench	Basket Maker III-early Pueblo I	39-97-10/20516



Pendants, Beads, and Unperforated Objects, Possibly Ornaments. (Actual size.)



Small Incised Tablet, Small Conical Stones, Small Tapered Stones, Beads, Crystals, Mosaic Fragment, and Pendants. (Approx. actual size.)

Figure 32

SMALL INCISED TABLET, SMALL CONICAL STONES, SMALL TAPERED STONES, BEADS, CRYSTALS, MOSAIC FRAGMENT, AND PENDANTS

a,	Small stone tablet with incised decoration.
b–c,	Small conical stones, use unknown.
d–e,	Small tapered stones, use unknown.
f–g, i–j,	Quartz crystals, not artificially modified.
h,	Fragments of turquoise mosaic, reset in original positions.
k,	String of minute gray stone beads, total 4200 to 4300.
l,	Turquoise fragment, notched for suspension.
m,	Turquoise bead.
n,	Gray stone bead.
o–p,	Turquoise fragments.
q, t,	Trapezoidal turquoise pendants.
r–s, u–v,	Subrectangular or ovoid turquoise pendants.

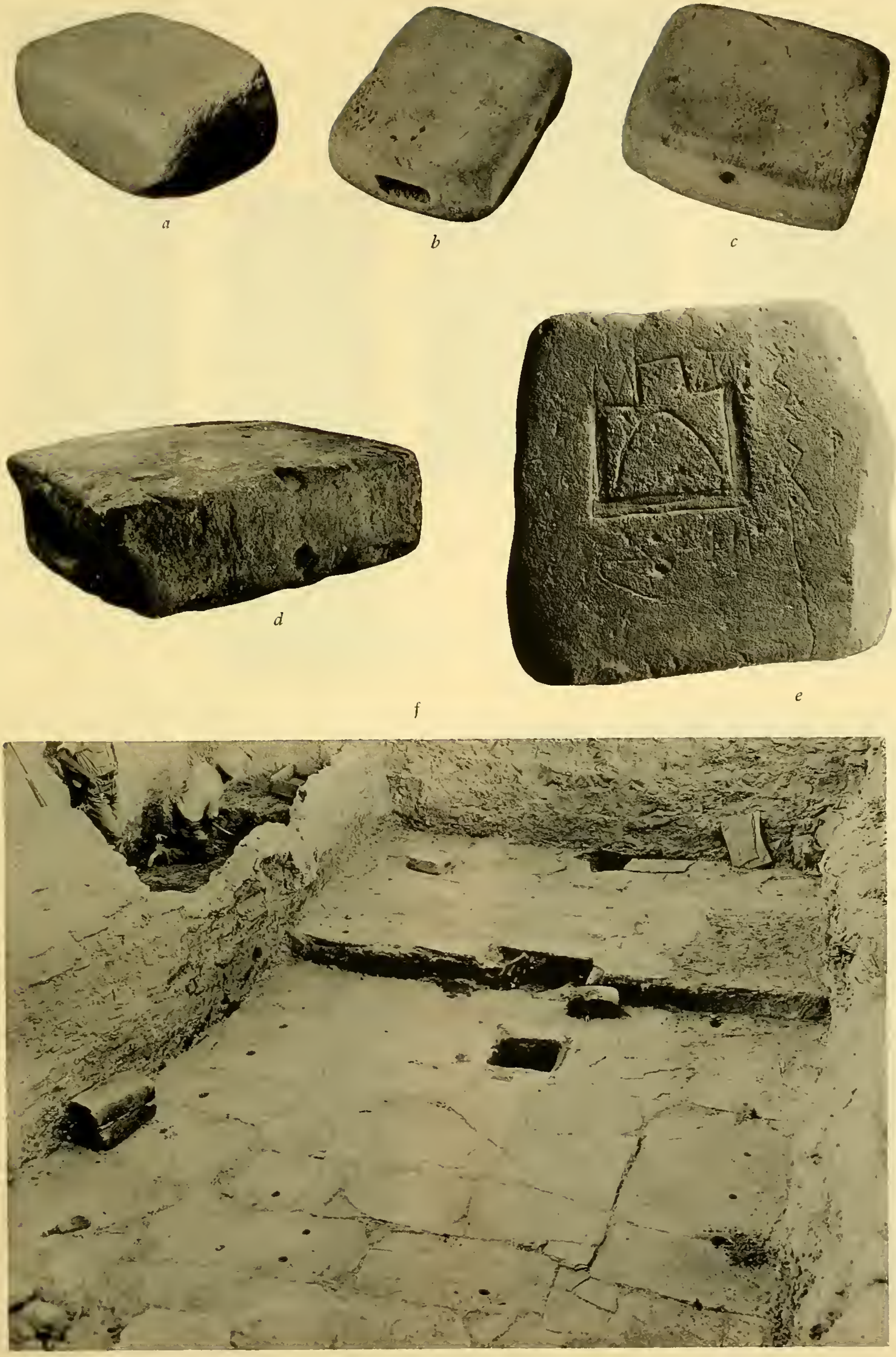
	Provenience			Catalogue Number
a,	Awatovi,	Room 244	Pueblo IV	36–131–10/8657
b,	"	Room 428, 100–150	Pueblo V	37–111–10/11909
c,	"	Room 428, 100–150	"	37–111–10/11908
d,	Site 111,	Room 4, S recess	Pueblo II	39–97–10/20416
e,	"	Room 4, S recess	"	39–97–10/20415
f,	Awatovi,	Test 46, Room 3, 50–100	Pueblo V	39–97–10/19864
g,	"	Room 742, 100–150	"	38–120–10/17675
h,	"	Test 57, Room 1, 50–100	Pueblo IV	39–97–10/19852
i,	"	Surface	Unassigned	36–131–10/8661
j,	"	Test 22, Square K, 0–50	Pueblo V	39–97–10/19862
k,	Site 241,	Burial	Pueblo III, burial weathered out of sand dune	39–97–10/20449
l,	Awatovi,	Room 489, 100–150	Pueblo V	38–120–10/17828
m,	"	Surface	Unassigned	37–111–10/11906
n,	"	Surface	"	35–126–10/5852
o,	"	Square 500L, 50–100	Pueblo V	37–111–10/11895
p,	"	Room 478, 0–50	"	38–120–10/17827
q,	"	Test 34, 300–350	Pueblo IV	38–120–10/17833
r,	"	Room 444, Burial 52	Pueblo V	37–111–10/11888
s,	"	Room 526, 200–250	"	37–111–10/11893
t,	Kawaika-a,	Surface	Pueblo III–IV	38–120–10/18154
u,	Awatovi,	Room 444, under floor	Pueblo V	38–120–10/17825
v,	Site 264,	Room 28, 0–50	Basket Maker III-early Pueblo I	39–97–10/20524

FIGURE 33

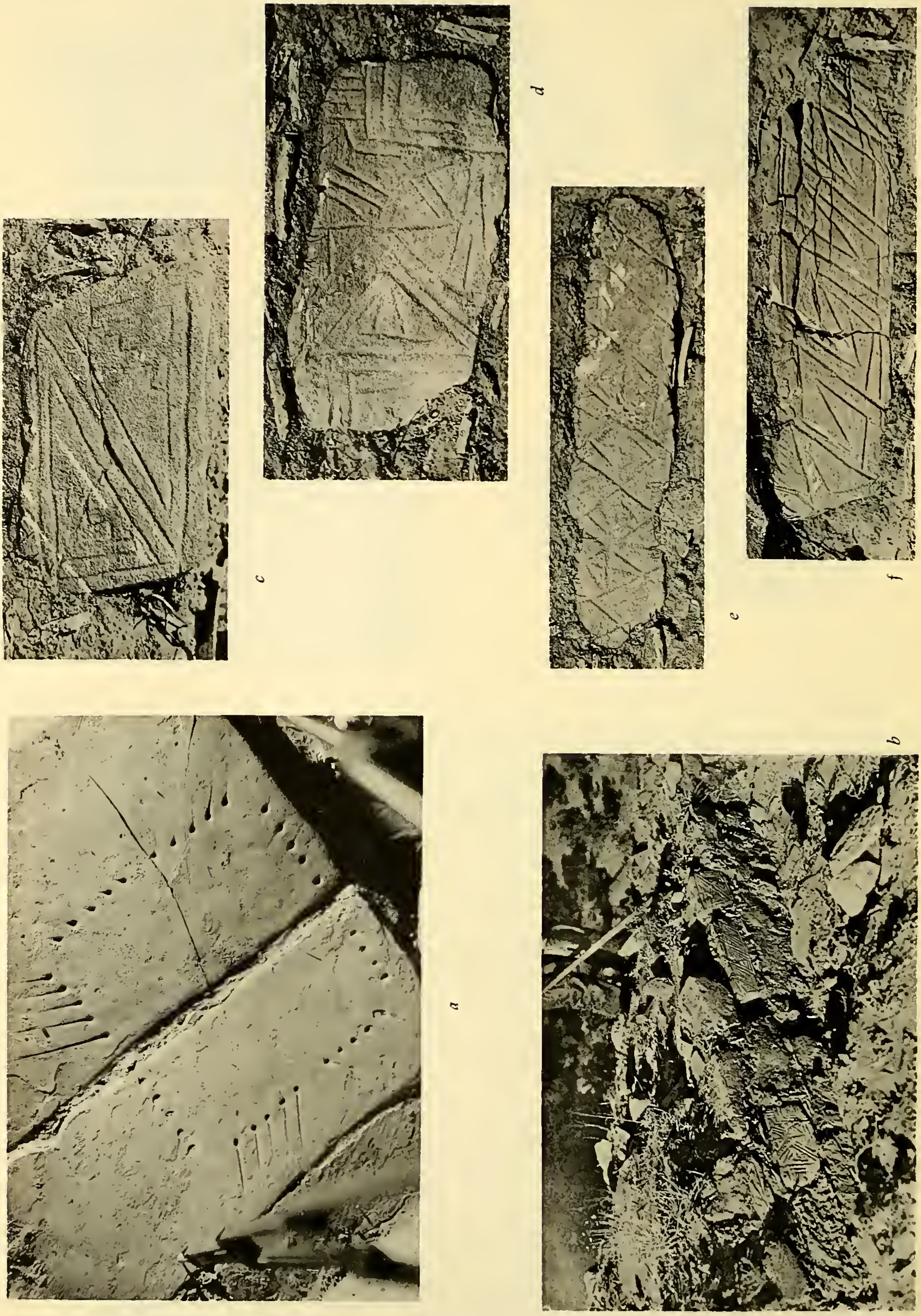
LOOMBLOCKS

a,	Loomblock from floor of Kiva A, size 30 by 25 by 15 cm.
b–c,	Pair of loomblocks found on floor of a living room, one on top of the other, against the north wall near the fireplace. Sizes, 31 by 29 by 14 cm. and 34 by 29 by 12 cm.
d,	One of 5 loomblocks on floor of a kiva. The others are shown in *f* of this figure. Size, 37 by 28 by 12 cm.
e,	Loomblock with incised decoration, from floor. Squarer and less carefully finished than most loomblocks. Size, 26 by 23 by 10 cm.
f,	Four loomblocks found. Another (*d,* of this figure) was out of the picture in the lower left. Rows of holes in the stone floor and on the southern bench were for securing the lower end of the vertical looms during weaving. The loomblocks were only used in the previous stage of weaving, the arranging of the warp threads.

	Provenience			Catalogue Number
a,	Awatovi,	Kiva A	Pueblo V	Left in the field
b,	”	Test 44, Room 1	”	”
c,	”	Test 44, Room 1	”	”
d,	”	Test 31, Room 1	Unassigned	Mus. of N. Arizona, 933/NA. 820.14
e,	”	Room 601	Pueblo V	37–111–10/11881
f,	”	Test 31, Room 1	”	None



Loomblocks. (Measurements are in legend.)



Stones with Incised Decoration. (No scale.)

Figure 34

STONES WITH INCISED DECORATION

a, Paving stones on southern bench of a kiva, with incised decoration (representing tadpoles?, or for scoring a game?).

b–f, Incised decoration on building stone, showing the stones in place, and individually.

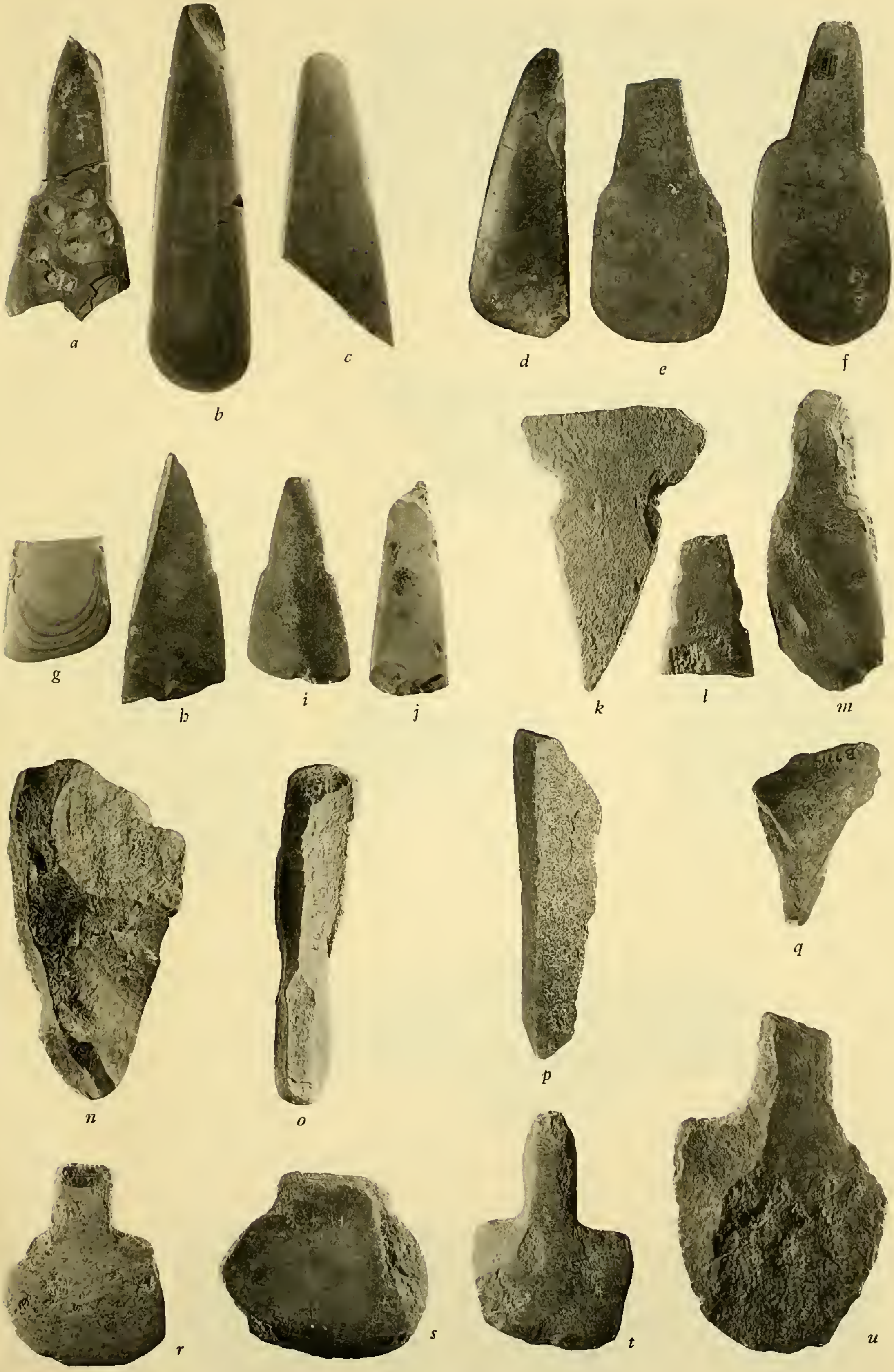
	Provenience			Catalogue Number
a,	Awatovi,	Room 529, S bench	Pueblo IV (Y–17)	None
b,	Site 4,	Wall (outer face) of late P III unit	Late Pueblo III unit, outer face of south wall	None
c,	"	"	"	35–126–10/6007
d,	"	"	"	35–126–10/6006
e,	"	"	"	35–126–10/6008
f,	"	"	"	None

Figure 35

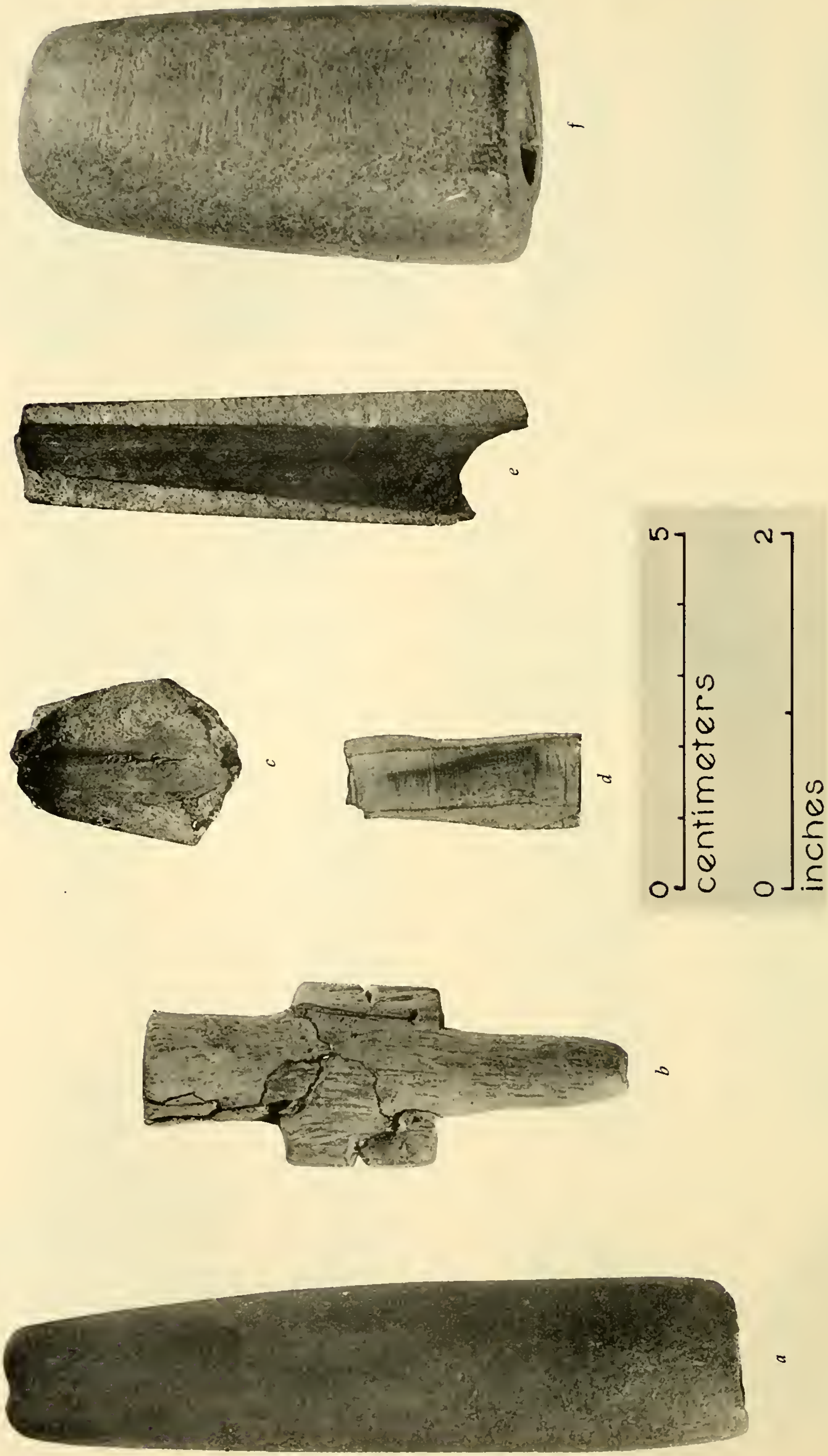
TCAMAHIAS, HOES (?), AND PICKS (?)

a–j, l–m,	Tcamahias, showing range of shapes and of excellence in finish and workmanship.
k,	Notched hoe (?).
n–q,	Picks (?).
r–u,	Hoes (?).

	Provenience			Catalogue Number
a,	Awatovi,	Room 519, 50–100	Pueblo V	37–111–10/11817
b,	"	Test 42, Room 1, 156–200	"	38–120–10/17593
c,	"	Room 96	Pueblo IV	35–126–10/5791
d,	"	Room 519, 50–150	Pueblo V	37–111–10/11818
e,	"	Test 55, Room 2, 50–100	Pueblo IV	39–97–10/19463
f,	"	Room 272	"	36–131–10/8627
g,	"	Test 38, Room 1, 100–150	Pueblo V	38–120–10/17591
h,	"	Room 253, AAA 0–25	Pueblo III	36–131–10/8638
i,	"	Test 42, Room 1, 156–200	Pueblo V	38–120–10/17594
j,	"	Room 462, 100–150	"	37–111–10/11816
k,	"	Room 274	Pueblo IV	36–131–10/8630
l,	"	Test 60, Room 1, 50–100	"	39–97–10/19464
m,	"	Room 723, pit B	Pueblo V	38–120–10/17276
n,	"	Test 26, Room 1, 50–100	Pueblo IV	37–111–10/11940
o,	Site 108,	Room 2, 150–200	Pueblo II–III	39–97–10/20391
p,	Awatovi,	Test 37, Room 1, 0–50	Pueblo IV	38–120–10/17083
q,	"	Surface	Unassigned	39–97–10/19849
r,	"	Surface	"	36–131–10/8629
s,	"	Room 271	Pueblo IV	36–131–10/8535
t,	"	Room 810	"	38–120–10/16958
u,	"	Test 60, Room 1, 50–100	"	39–97–10/19902



Tcamahias, Hoes (?), and Picks (?). (Scale: 1/4.)



Tubular Pipes.

FIGURE 36

TUBULAR PIPES

a–e,	Tubular pipes, presumably for tobacco smoking. Notched flanges decorate *b.* Note marks of cylindrical drills in *d.*
f,	Unfinished pipe (?). Hole in lower end is only 0.8 cm. deep.

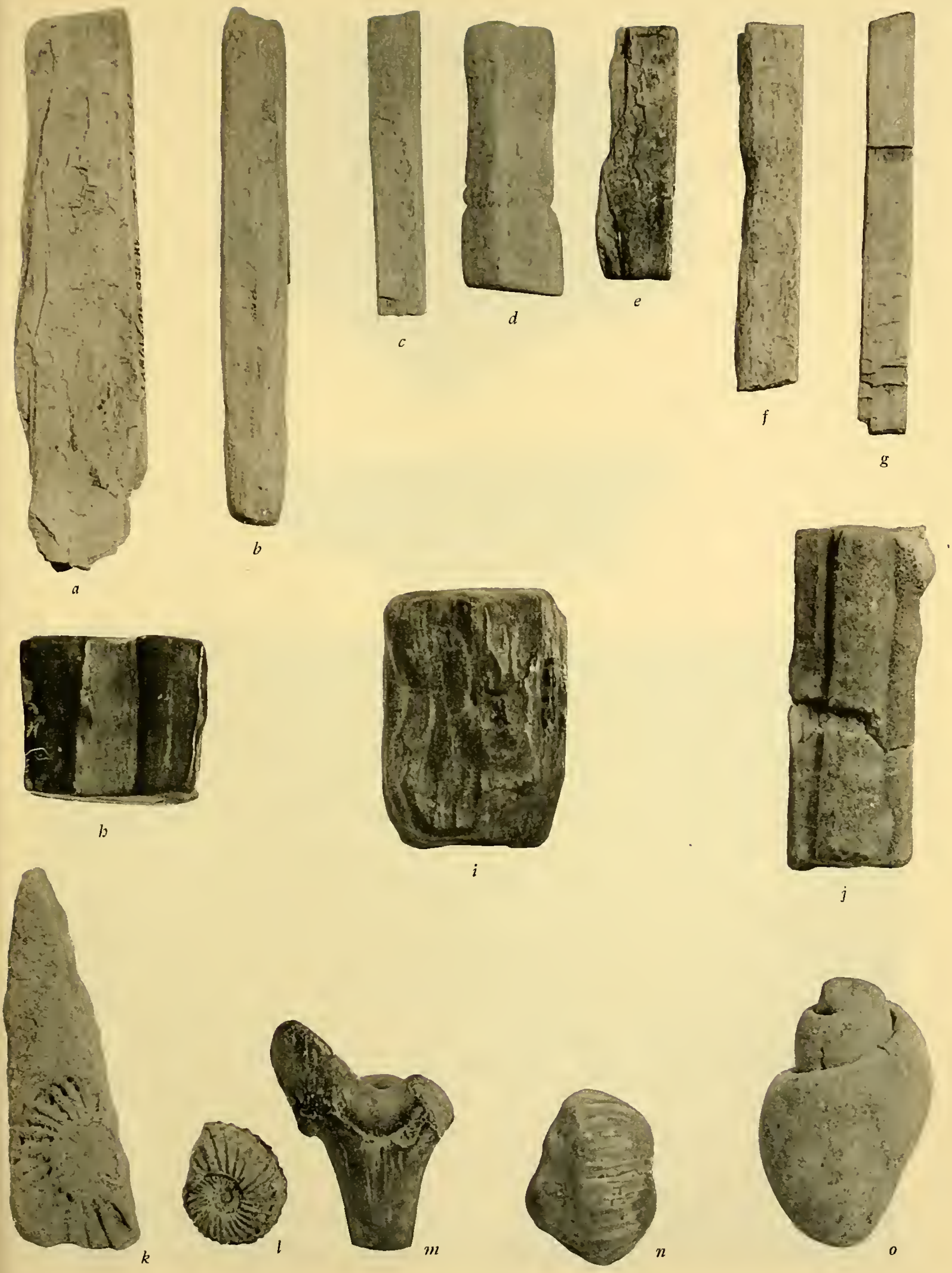
	PROVENIENCE			CATALOGUE NUMBER
a,	Site 264,	Room 17, 100	Basket Maker III-early Pueblo I	39-97-10/20511
b,	Awatovi,	Test 58	Pueblo IV	39-97-10/19859
c,	Site 108,	Surface	Pueblo II–III	39-97-10/20393
d,	Awatovi,	Test 14, Room 4, 50–100	Pueblo IV	37-111-10/11902
e,	"	Room 529, 0–50	Pueblo V	39-97-10/19858
f,	"	Room 810, 50–100	Pueblo V	38-120-10/17669

FIGURE 37

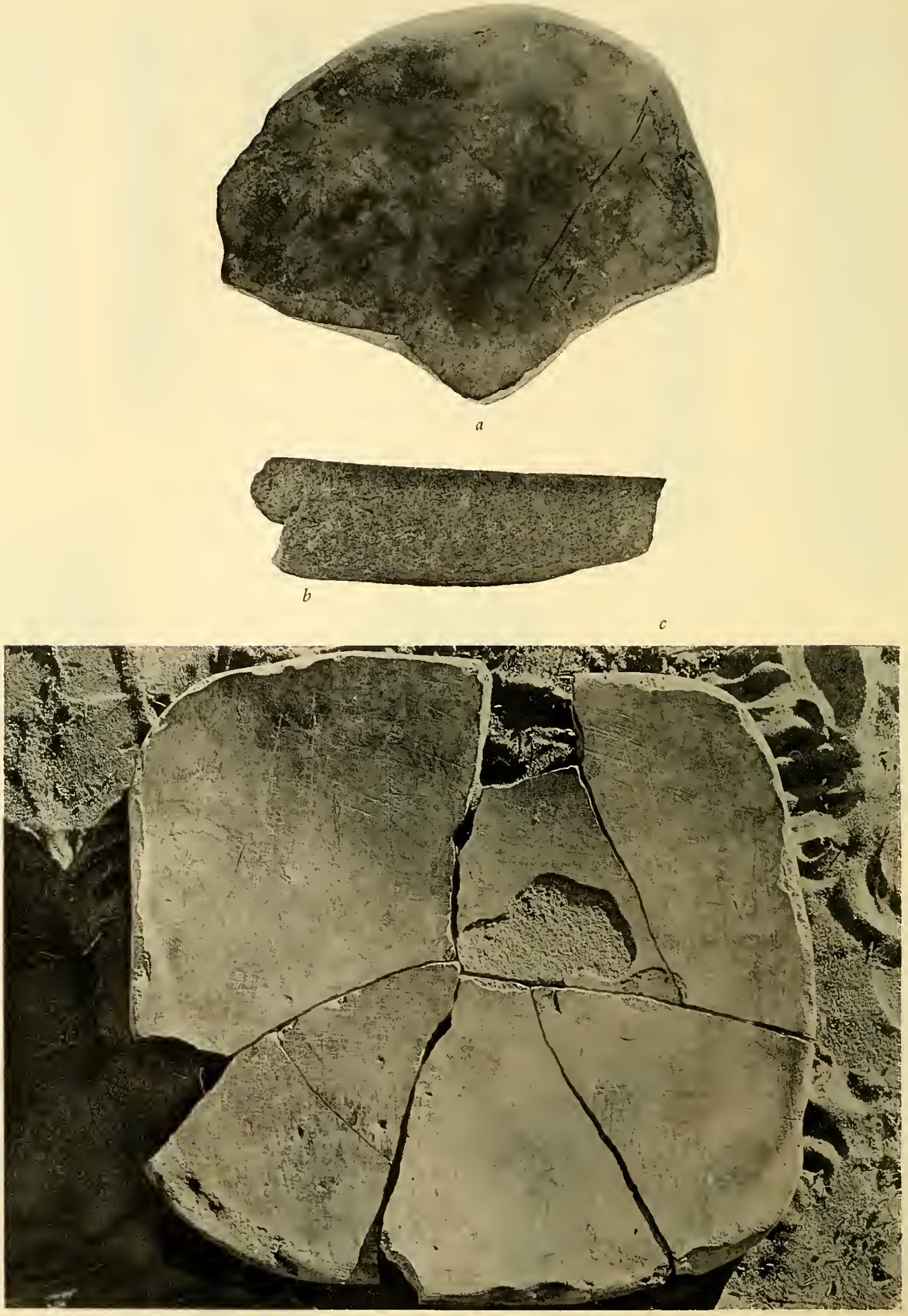
PETRIFIED WOOD, STALACTITE (?), FOSSILS

a–g,	Slivers of dull brown petrified wood, slightly polished but not intentionally shaped.
h–i,	Fragments of agatized wood, highly polished.
j,	Fragment of stalactite (?).
k–l,	Fossil cephalopods.
m,	Fossil shark tooth.
n,	Fossil late Palæozoic brachiopod.
o,	Fossil gastropod.

	PROVENIENCE			CATALOGUE NUMBER
a,	Awatovi,	Test 31, Room 1, 125–175	Pueblo V	38–120–10/17822
b,	"	Room 630, 0–50	"	37–111–10/11928A
c,	"	Room 448, AA 75–125	"	None
d,	"	Test 42, 156–200	"	38–120–10/17824
e,	"	Room 434, Burial 85	"	37–111–10/11911
f,	"	Room 768	"	None
g,	"	Room 772	"	None
h,	"	Test 52, Room 7, 0–50	Pueblo IV	39–97–10/19877
i,	"	Room 316, 115–140	"	36–131–10/8545
j,	"	Test 57, Room 1, 50–100	"	39–97–10/19898
k,	"	Test 14, Room 2, 0–70	"	36–131–10/8669
l,	Site 108,	Room 2, 0–75	Pueblo II–III	39–97–10/20394
m,	Awatovi,	Test 52, Room 7, 100–150	Pueblo IV	39–97–10/20053
n,	"	Section 3, 50–100	Unassigned	37–111–10/11929
o,	"	Room 294, AA 100–150	Pueblo III	36–131–10/8668



PETRIFIED WOOD, STALACTITE (?), FOSSILS. (Actual size.)



Cooking Slabs. (Measurements are in legend.)

FIGURE 38

COOKING SLABS

a,	Fragment of cooking slab, originally roughly circular, present diameter 29 cm.
b,	Cross-section of cooking slab, showing penetration of grease from polished upper surface, resulting in dark zone. Thickness 2.7 cm.
c,	Cooking slab, subrectangular, approximately 21 cm. wide.

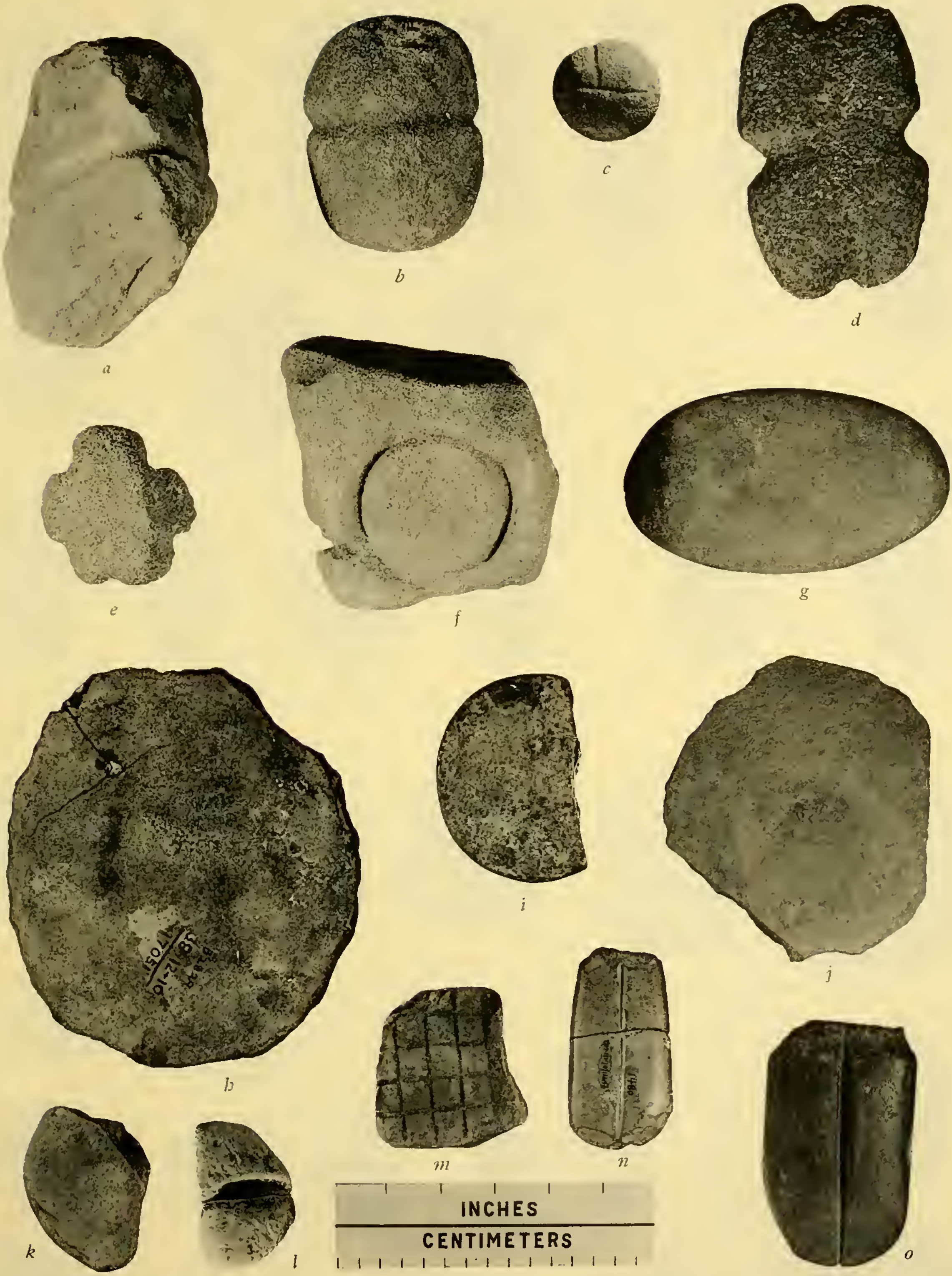
	Provenience			Catalogue Number
a,	Awatovi,	Room 719, 50–100	Pueblo V	38–120–10/17053
b,	"	Room 717, 50–100	"	38–120–10/18448
c,	"	406, 50–100	"	None

Figure 39

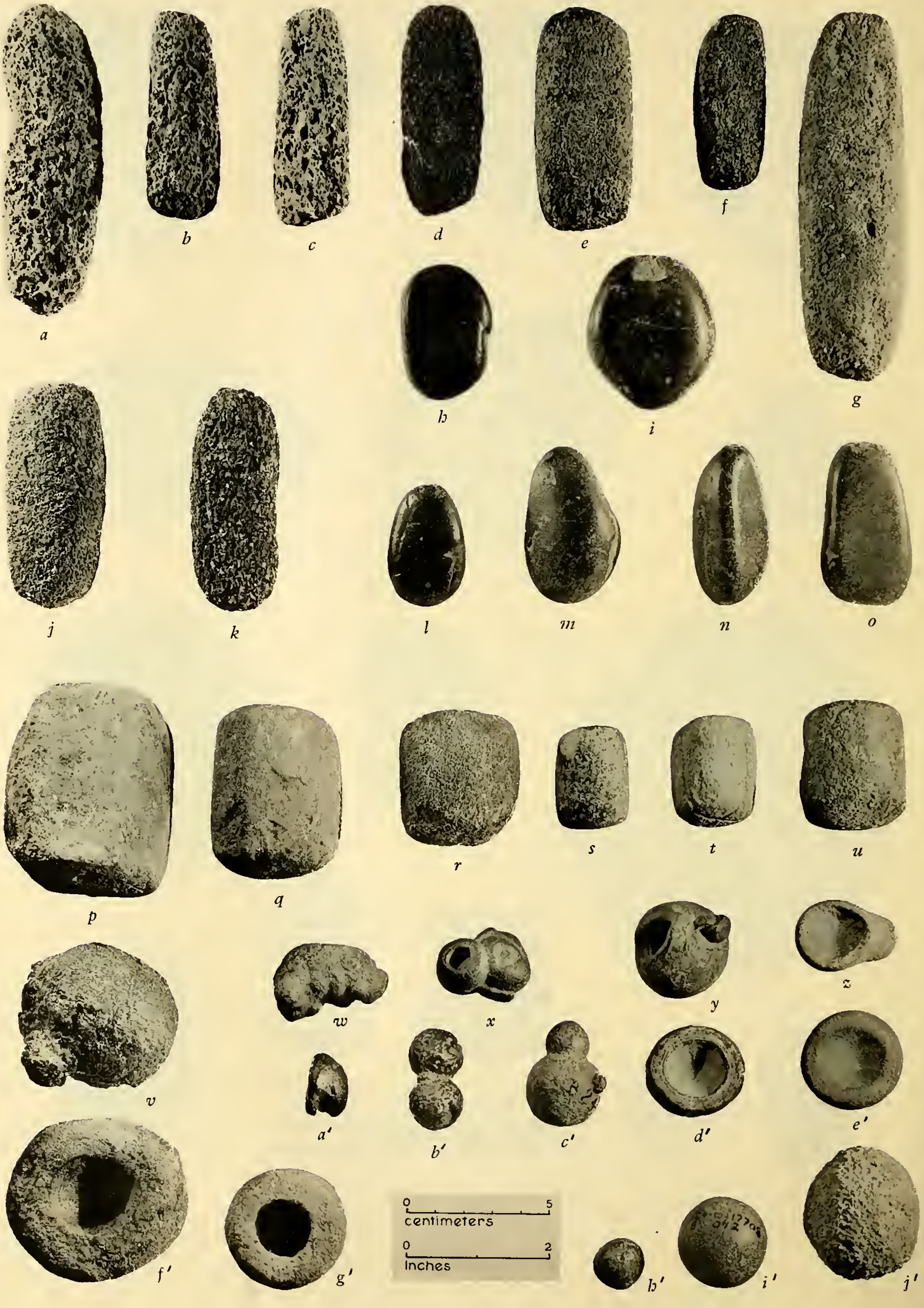
WEIGHTS (?), VARIOUS UNIQUE OBJECTS OF UNKNOWN USE

a–c,	Grooved weights (?).
d,	Notched weight (?).
e,	Notched disk, use unknown, possibly for abrading.
f,	Stone with deep annular groove, use unknown.
g,	Flat polished pebble, use unknown.
h–k,	Jar lids (?).
l,	Grooved chalk object.
m,	Incised stone, painted orange, use unknown.
n,	Polished "celt," fragments found in different rooms.
o,	Reworked axe blade, partly sawed in half.

	Provenience			Catalogue Number
a,	Awatovi,	Test 64, 0–100	Pueblo IV	39–97–10/19747
b,	"	Surface	Unassigned	37–111–10/11803
c,	Pink Arrow,	Room 9, 75–100	Pueblo III–IV	39–97–10/20177
d,	Awatovi,	Test 22, Room 10, 0–175	Pueblo V	37–111–10/11801
e,	"	Surface	Unassigned	38–120–10/17658
f,	"	Room 35	Pueblo V	35–126–10/5788
g,	"	Room 465, Burial 92	"	37–111–10/11725
h,	"	Room 708, 100–150	"	38–120–10/17051
i,	"	Test 14, Room 2, 70–100	Pueblo IV	36–131–10/8623
j,	"	Room 207, lower	Pueblo III	36–131–10/8621
k,	"	Room 306, 0–85	Pueblo IV	36–131–10/8509
l,	"	Room 814, 0–50	Pueblo V	38–120–10/17678
m,	"	Room 263	Pueblo IV	36–131–10/8658
n,	"	Upper half, Test 42, 100–156;	Pueblo V	37–111–10/11696
		lower half, Room 620, 0–50		38–120–10/17582
o,	"	Test 55, Room 2, 50–100	Pueblo IV	39–97–10/19724



Weights (?). Various Unique Objects of Unknown Use



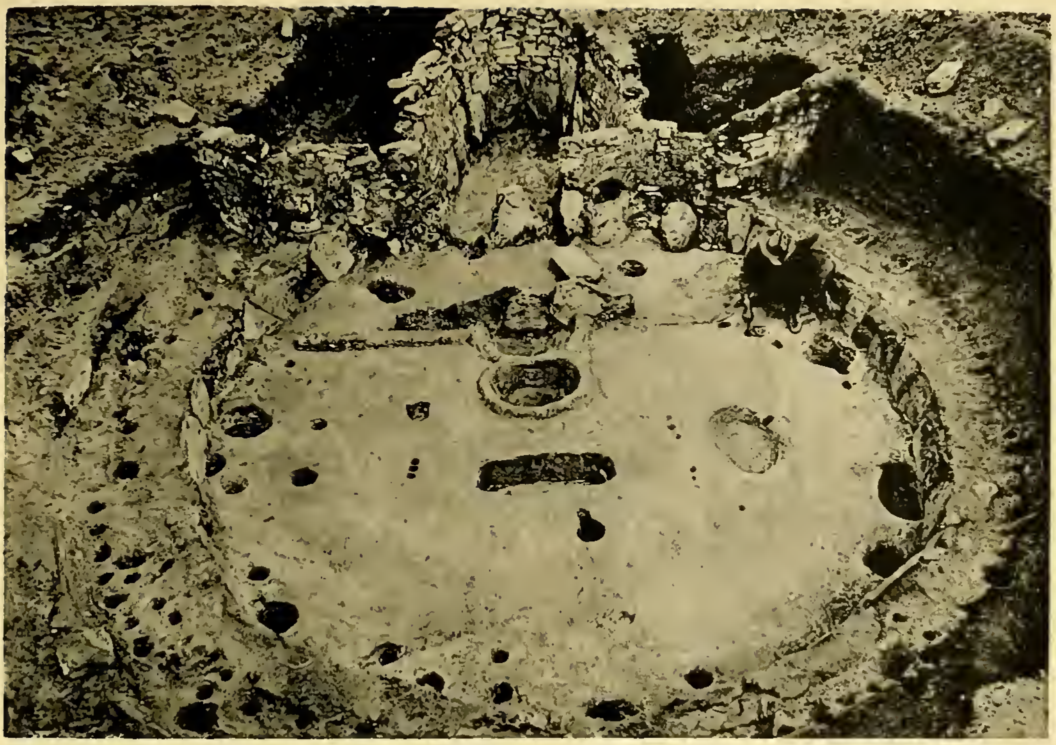
Small Rough Cylindrical Stones, Thick Cylindrical Stones, Polishing Pebbles, and Concretions.

FIGURE 40

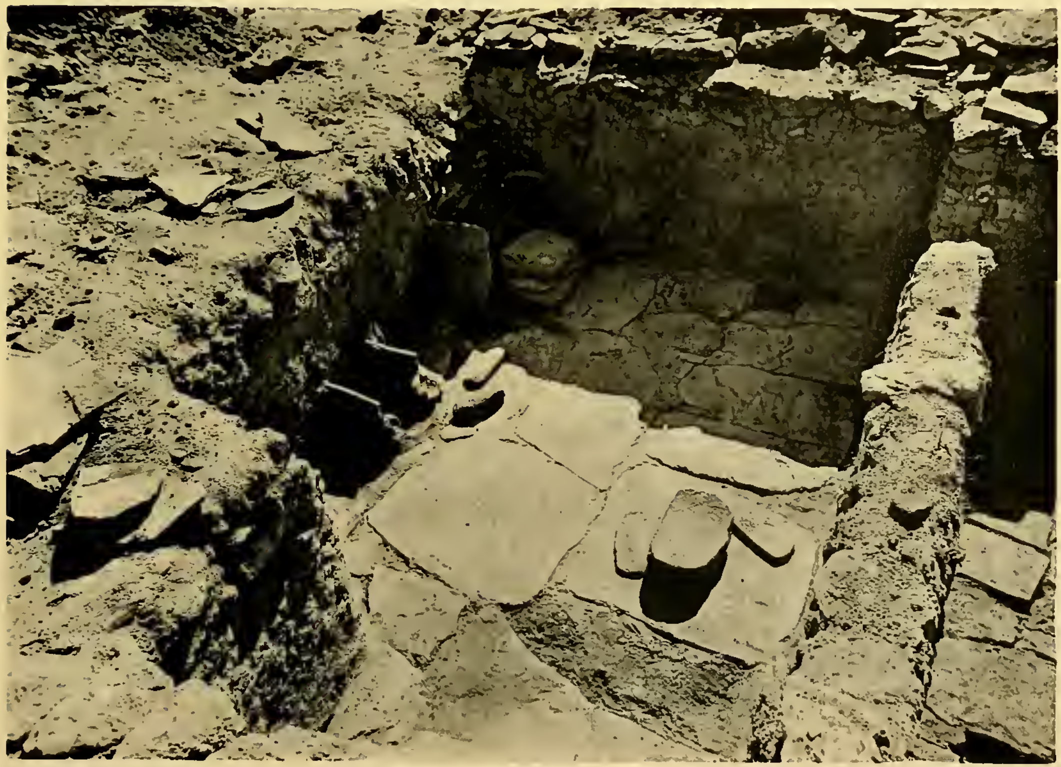
SMALL ROUGH CYLINDRICAL STONES, THICK CYLINDRICAL STONES, POLISHING PEBBLES, AND CONCRETIONS

a–g, j–k,	Small rough cylindrical stones, use unknown. Vesicular tuff, *a–c;* others sandstone.
h–i, l–o,	Polishing pebbles, showing maximum degree of faceting attained.
p–u,	Thick cylindrical stones, use unknown.
v–c′,	Irregularly shaped concretions (fetishes ?).
d′–g′,	Bowl-shaped concretions, not artificially modified.
h′–j′,	Spherical concretions not artificially modified.

	Provenience			Catalogue Number
a,	Awatovi,	Room 201	Pueblo III	36–131–10/8610
b,	"	Room 239	Pueblo IV	36–131–10/8614
c,	"	Room 202	Pueblo III	36–131–10/8611
d,	"	Room 244	Pueblo IV	36–131–10/8616
e,	"	Test 25, Room 1, 0–50	"	37–111–10/11938
f,	"	Room 316, 0–100	"	36–131–10/8544
g,	"	Room 243, AA 100–150	"	36–131–10/8615
h,	"	Room 768	Pueblo V	38–120–10/17392
i,	"	Test 60, Room 1, 50–100	Pueblo IV	39–97–10/19841
j,	"	Room 284, 100–150	"	36–131–10/8617
k,	"	Between Room 211 & Room 216	"	36–131–10/8612
l,	"	Room 788	"	38–120–10/17406
m,	"	Test 10, Room 3	"	36–131–10/8585
n,	"	Test 14, Room 5, 0–50	"	38–120–10/17428
o,	"	Room 788, 100–150, below roof	Pueblo V	38–120–10/17410
p,	Pink Arrow,	Room 32, 200–250	Pueblo III–IV	39–97–10/20162
q,	Site 108,	Room 2, 75–100	Pueblo II–III	39–97–10/20390
r,	Awatovi,	Square 500H, 100–150	Pueblo IV	37–111–10/11924
s,	"	Room 298, 200–270	Pueblo III	36–131–10/8646
t,	Pink Arrow,	Square C, 0–75	Pueblo III–IV	39–97–10/20180
u,	Awatovi,	Room 231, AAA 100–150	Pueblo III	36–131–10/8641
v,	"	Room 726	Pueblo V	38–120–10/17690
w,	"	Room 768	"	38–120–10/17694
x,	"	Surface	Unassigned	37–111–10/11939
y,	"	Test 14, Room 5, 0–50	Pueblo IV	38–120–10/17699
z,	"	Square 500G, 0–50	Pueblo V	37–111–10/11923
a′,	"	Room 486, pit under floor	"	38–120–10/17687
b′,	"	Test 22, Room 5, 0–50	"	37–111–10/11934
c′,	"	Room 456, 80–115	"	38–120–10/17685
d′,	"	Room 438, 50–100	"	37–111–10/11864
e′,	"	Room 5, test pit	Pueblo IV	35–126–10/5836
f′,	"	Room 632, 50–100	Pueblo V	37–111–10/11878
g′,	"	Room 272, 100–150	Pueblo IV	36–131–10/8347
h′,	"	Test 28, Room 1, 45–115	Pueblo V	38–120–10/17716
i′,	"	Test 14, Room 5, pit in SW corner	Pueblo IV	38–120–10/17708
j′,	"	Test 14, Room 6, 50–100	"	38–120–10/17714



a



b

a, Site 264, Room 16, with metate leaning against rear wall at right, as found. This metate is shown also in Figure 16, *a*. *b*, Awatovi, Test 5, with metates and manos on floor, as found. Note the niches in far and left walls.

(Continued from inside front cover)

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